THE BRITISH VETERINARY JOURNAL

MARCH 1961

VOLUME 117 No. 3.

Editor
J. A. LAING

Editorial Board
Sir JOHN RITCHIE, Chairman

R. A. ALEXANDER (*South Africa*)
W. G. BEATON (*Kenya*)
I. S. BEATTIE (*Edinburgh*)
Sir THOMAS DALLING (*Edinburgh*)
J. FRANCIS (*Australia*)
C. S. GRUNSELL (*Bristol*)
J. A. HENDERSON (*Canada*)
W. M. HENDERSON (*Brazil*)
J. R. M. INNES (*United States*)
H. G. LAMONT (*Belfast*)
R. S. MARSHALL (*London*)
J. C. NEWHOOK (*New Zealand*)
E. J. L. SOULSBY (*Cambridge*)
W. L. WEIPERS (*Glasgow*)
E. G. WHITE (*Liverpool*)

Published monthly by

BAILLIERE
TINDALL
AND COX

7 & 8 Henrietta St.
London W.C.2.

WESTERN AUSTRALIA STATE PUBLIC SERVICE DEPARTMENT OF AGRICULTURE

SENIOR VETERINARY PARASITOLOGIST
(Permanent)

Salary Range:
£A2,403 – £A2,577 (gross) per annum on current basic wage according to qualifications and experience.

Qualifications:
Recognised degree in Veterinary Science, Zoology or related field with considerable post graduate experience in veterinary parisitology. Qualifications in statistical methods an advantage.

Duties:
Responsible for; setting up of epidemiology and drenching trials; co-ordination of laboratory work with field studies: direction of parasitology research; analysis of data and preparation of reports; and under direction of Chief Veterinary Pathologist, co-operation in parasitological aspects of all conditions affecting the health and well-being of livestock in Western Australia.

Transport:
Reasonable amount allowed for transport of appointee and dependent family to Western Australia provided bond entered into serve State for period of three years.

Conditions of Service:
Superannuation benefits, three months' long service leave after seven years' continuous service, cumulative sick leave entitlements and other general conditions applicable to permanent public servants.

Applications stating age, qualifications and experience should be addressed by 1st April, 1961, to:

PUBLIC SERVICE COMMISSIONER.
184 ST. GEORGE'S TERRACE, PERTH.

UNIVERSITY OF GLASGOW

Chair of Veterinary Medicine

The University Court will shortly consider an appointment as from 1st October, 1961, to the Chair of Veterinary Medicine. The Chair is a full-time appointment.

Particulars as to duties, salary and conditions of appointment may be obtained from the undersigned, with whom applications (20 copies) should be lodged not later than 10th March, 1961.

ROBT. T. HUTCHESON,
Secretary of University Court.

ANIMAL BEHAVIOUR

This *Journal* is issued in March and September each year, and publishes original papers on animal behaviour and other subjects from contributors in many countries throughout the world. Reports of researches, reviews and correspondence are included, and it also contains the Proceedings of the Association for the Study of Animal Behaviour and of the Section of Animal Behaviour and Sociobiology of the Ecological Society of America and the American Society of Zoologists of which it is the official publication.

Annual Subscription £2 10s. 0d.
U.S.A. and Canada $8

Published by
Baillière, Tindall & Cox
7-8 Henrietta Street
London, W.C.2.

2 DOSES
'Leptovax-plus'
BW&CO
ONE DOSE
'Epivax-plus'
BW&CO

No doubt
about the
diagnosis—
ACETONAEMIA

No doubt
about the
treatment—
PREDSOLAN

Injection of Predsolan in aqueous suspension, raises blood sugar levels and, provided there are no complications present, appetite and milk yield return to normal in a few days. The usual dose of Predsolan for acetonaemia is 10 ml. In severe cases up to 20 ml may be given; occasionally a second injection is necessary.

PREDSOLAN makes all the difference

Ready-to-inject suspension of prednisolone 10 mg/ml in 10 ml vials

PREDSOLAN is a Glaxo trade mark

GLAXO

Veterinary Department—GLAXO LABORATORIES LTD.,
GREENFORD, MIDDLESEX BYRon 3434

The skilled hand of the Veterinary Surgeon . . .

reaches with confidence for . . .

'XYLOTOX'

(REGD)

Veterinary self-sterilising Local Anæsthetic

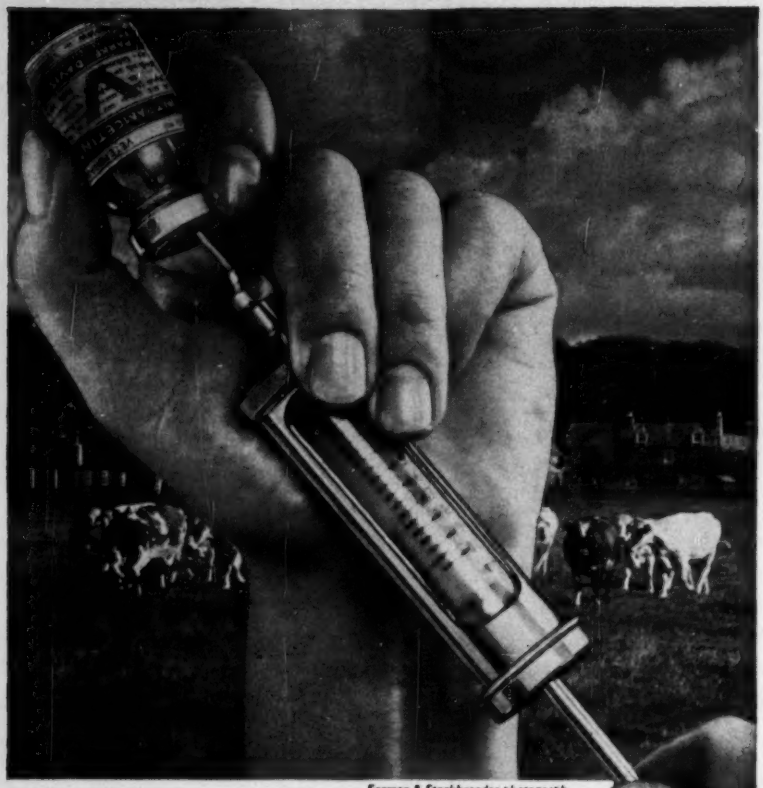
for safe, deep, prolonged anæsthesia
and extreme rapidity of action.

You can be certain of XYLOTOX.

WILLOWS FRANCIS LTD
73/75 SHACKLEWELL LANE LONDON E8
Tel: CLissold 6301 (5 Lines) Grams: Forty Hock London

MAKERS OF VETERINARY SPECIALITIES
EXCLUSIVE TO THE PROFESSION SINCE 1751

Ready-to-use



Farmer & Stockbreeder photograph

Intramycetin

CHLOROMYCETIN* in aqueous suspension.
For intramuscular use in scours in cattle, metritis in sheep, scours in pigs, gastro-enteritis in horses and whenever broad spectrum antibiotic therapy is urgently indicated.

No mixing or preliminary manipulation—easily taken into syringe.

Available in vials of 10 ml. and 30 ml., containing the equivalent of 1¼ g. and 4¼ g. Chloromycetin respectively.

*Trade Mark

PARKE-DAVIS

PARKE, DAVIS & COMPANY · HOUNSLOW · MIDDLESEX · TEL.: HOUNSLOW 2361
(Inc. U.S.A. Liability Limited)
WPS-1068

Small Animal Veterinarians Report . . .

profound improvement in OTITIS EXTERNA (chronic ears) and STUBBORN SKIN INFECTIONS

AFTER THERAPY WITH

Tri-Adcortyl

OINTMENT

- ***anti-inflammatory***
- ***antipruritic***
- ***antibacterial***
- ***antifungal***

Tri-Adcortyl combines, in one formula, the benefits of corticoid, antibacterial and antifungal therapy . . . and provides the veterinarian with an "all-in-one" therapeutic agent for a wide range of dermatologic and non-dermatologic disorders of dogs and cats. Tri-Adcortyl is particularly effective against otitis externa — "chronic ears"— in all its forms.

Tri-Adcortyl contains . . .

TRIAMCINOLONE ACETONIDE to give rapid, potent, topical corticosteroid benefits without systemic reactions. Triamcinolone acetonide is 40 times more potent than cortisone acetate, 10 times more potent than prednisolone, when tested in laboratory animals.

NEOMYCIN and *GRAMICIDIN*, two potent antibiotics that together provide comprehensive antibacterial therapy against a wide variety of gram-positive and gram-negative organisms.

NYSTATIN, an antifungal antibiotic that has proved highly effective in preventing and treating most Candida (Monilia) albicans infections.

INDICATIONS: acute and chronic otitis externa . . . dermatologic disorders characterized by inflammation and dry or exudative dermatitis, particularly when complicated by bacterial or monilial infection . . . interdigital cysts . . . anal gland infection and inflammation . . . contact dermatitis . . . cutaneous moniliasis . . . and many other dermatologic and non-dermatologic disorders.

Veterinarians report their success with Tri-Adcortyl

OTITIS EXTERNA: ". . . profound improvement after three days."

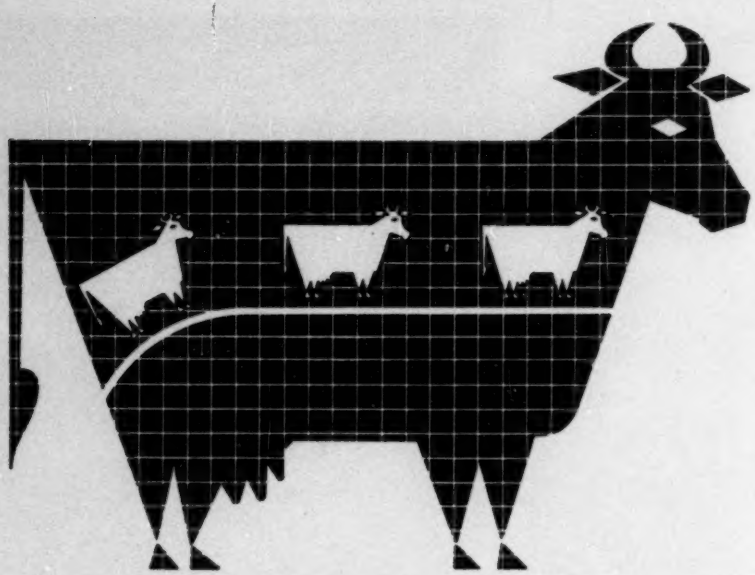
ACUTE INFLAMMATION OF INTERDIGITAL WEB: ". . . in two days, regression of inflammation and discomfort . . . no recurrence in four weeks."

INTENSE PRURITUS OF GLABROUS PART OF ABDOMEN: ". . . minute applications bring immediate relief."

Tri-Adcortyl is a Squibb-Mathieson Product

E. R. SQUIBB & SONS LIMITED
(*Veterinary & Agricultural Division*)

EDWARDS LANE · SPEKE · LIVERPOOL 24



NEW!
and now you can order the
90 ml.
economy vial

SUSTAINED SUCCESS

'Distaquaine' is the name under which procaine penicillin as an aqueous suspension was first introduced to British veterinary—as well as general—medicine. It is the name that naturally comes to mind when treatment of an acute or chronic infection calls for sustained penicillin therapy, and which continues to be associated with an improved prognosis in a wide range of animal diseases. 'Distaquaine' Suspension Veterinary is supplied in economical multi-dose vials and gives reliable therapeutic levels of penicillin for 24 hours.

Packs : *Multi-dose vials of 10ml., 30ml. and 90ml (300.000 i.u. per ml.)*

'Distaquaine' SUSPENSION VETERINARY

Detailed literature is available on request to the Veterinary Department

DC&B

THE DISTILLERS COMPANY (*Biochemicals*) LIMITED

Broadway House, The Broadway, Wimbledon, London, S.W.19 Telephone: LIBerty 6600

Owners of the trade mark 'Distaquaine'

APW 4/80A

NARPHEN *is the SNP brand of phenazocine (2′-hydroxy-5,9-dimethyl-2-phenethyl-6,7-benzomorphan hydrobromide). It is a new synthetic analgesic more powerful than morphine and with fewer and less pronounced side effects. Weight for weight, it does not induce stupor or sedation to the same degree as morphine and other narcotic drugs.*

NARPHEN

MORE POWERFUL THAN MORPHINE

- NARPHEN is many more times effective than morphine as an analgesic in the dog.
- It is quicker-acting and longer-lasting in effect than morphine or pethidine.
- Side effects such as respiratory depression, hypotension, nausea and vomiting are rare after therapeutic doses.

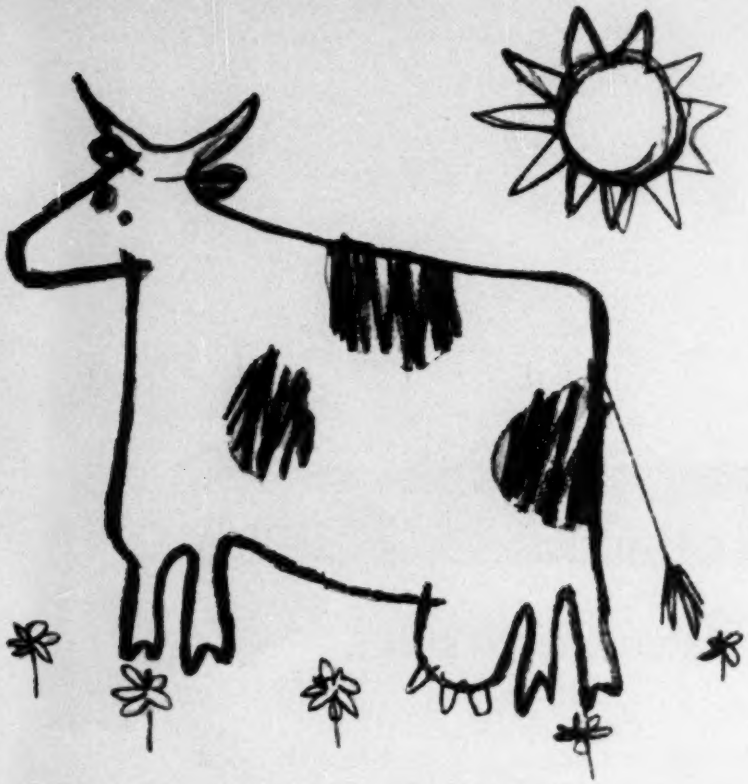
NARPHEN Veterinary is indicated in severe acute or chronic pain in the dog, especially as an adjunct to general anaesthetics and to relieve pain post-operatively.

NARPHEN *is subject to the Dangerous Drugs Regulations.*

NARPHEN Veterinary is available in boxes of 10 and 100 1.1 ml. ampoules each containing 2 mg. per 1 ml.

Smith & Nephew *Pharmaceuticals* Limited

WELWYN GARDEN CITY • HERTFORDSHIRE



Bovine mastitis has its sunny side

Terramycin Intramammary Solution begins working at once to reduce inflammation of the udder and to prevent any changes in the tissue which would permanently harm milk production. It rapidly disperses throughout the tissue and is eliminated soon after treatment.

Availability: Tubes of ½ oz. (14.2 G.) packed in cartons containing 6 tubes.

Terramycin* BRAND OF OXYTETRACYCLINE | Intramammary Solution

PFIZER LIMITED · SANDWICH · KENT *Trade Mark 10038 Pfizer

Brit. vet. J. (1961), **117**, 97

A FATAL ULCERATIVE MUCOSAL CONDITION OF SHEEP ASSOCIATED WITH THE VIRUS OF CONTAGIOUS PUSTULAR DERMATITIS

By J. H. Darbyshire

Central Veterinary Laboratory, New Haw, Weybridge

Contagious pustular dermatitis is a familiar disease of sheep. It affects them particularly in their first year and is characterized by vesiculopapular eruptions leading to scab formation around the oral commissures. These scabs remain until healing beneath is almost complete. Lesions are often confined to this anatomical site although Glover (1928) has described severe forms involving extensions to the nose, mucous membranes of the mouth, vulva, cornea and to other external parts of the body such as the coronet and tail.

Workers outside the United Kingdom have also recorded even more severe forms, in which the disease spread to other parts of the alimentary tract and internal organs of the body and resulted in a serious mortality rate.

The disease described in this paper had the characteristics of a severe form of contagious pustular dermatitis. The outbreak was investigated further to confirm the presence of the virus of contagious pustular dermatitis, to determine that it was not due to a virus similar to that of mucosal disease of cattle and, because of some features of the condition, to ensure that it was not blue-tongue.

HISTORY

Of several outbreaks reported, one in Kent and the remainder in Berkshire, that in Kent was investigated in detail. Here, the affected animals originated from local farms.

The sudden occurrence of unexplained deaths in lambs being used for contagious pustular dermatitis and louping-ill vaccine production first drew attention to an ulcerative mucosal condition. All the lambs were under one year of age and external oral lesions of contagious pustular dermatitis were evident. At no time did these lesions spread externally to other parts of the body.

The total number of deaths and the percentage mortality ascribed to the condition for this outbreak are shown in Table I. It will be noted that deaths ceased with Group H. All lambs were kept in groups at pasture with a supplementary diet of sugar-beet pulp and crushed oats. The outbreaks were limited to a period somewhat under two months in the acute form and for approximately three months overall.

TABLE I
MORTALITY IN THE INITIAL OUTBREAK OF CONTAGIOUS PUSTULAR DERMATITIS IN KENT

Group	*Date received*	*No. of animals*	*No. of deaths*	*Mortality per cent*
A	16. 7.58	20	4	20
B	29. 7.58	50	39	78
C	8. 8.58	60	9	15
D	22. 8.58	96	23	23·9
E	7.10.58	70	2	2·8
F	8.10.58	52	8	15·4
G	20.10.58	200	14	7
H	5.12.58	41	0	0
I	18.12.58	9	0	0

CLINICAL FEATURES OF THE OUTBREAK

Initially, the predominant signs were pneumonic in nature, with mucopurulent nasal discharge, cyanosis of the tongue and congestion of the turbinate bones. There was evidence of restricted buccal ulceration. As the disease spread, the pneumonic signs tended to disappear and erosive stomatitis quickly became the dominant feature. In a few instances there was dropsy of the head region. When animals were first noticed to be ill, temperatures were in the region of 105°F. Gastroenteritis of varying degrees of severity followed the initial ulceration of the mouth.

Severely affected animals became rapidly emaciated, then comatose, and died within a week. Subclinical infection occurred in otherwise healthy sheep. These showed healing ulcers at all sites within the buccal cavity but most frequently on the dorsum of the tongue immediately distal to the prominence.

Where fresh oral lesions were seen, they tended to follow the course of those of a typical pox virus disease. But in the majority of cases the lesions were roughly circular papulo-erosive areas, whitish in colour with a surrounding zone of hyperaemia which rapidly became necrotic without scab formation. These ulcers were chiefly from 0·5–1·0 cm. in diameter but some were the size of a pin-head, particularly on the hard palate. In a few cases some erythema of the buccal mucosa was apparent with no extensive desquamation of the epithelium.

PATHOLOGICAL CHANGES

The macroscopic pathological changes took the form of myocardial haemorrhages and acute myocarditis, excess pericardial and peritoneal fluids and haemorrhagic pneumonia with necrotic foci principally in the apical lobes of the lungs. Tracheitis was a common feature. Punctate haemorrhages were present on the capsule of the spleen and in the cortex of the kidney. The latter was pale in colour and enlarged. The mesenteric and retropharyngeal lymph nodes were enlarged and either congested or oedematous. Lesions in the liver varied from generalized degeneration with an overall pale or orange coloration to discrete focal necrosis.

Occasionally, the mammary tissue was haemorrhagic. Inflammatory changes in the gastrointestinal tract occurred with multiple longitudinal erosions of the oesophageal mucosa. Sometimes single ulcers were to be seen in the abomasum

or small intestine. The colon often appeared striped and, less frequently, the rectum displayed similar lesions like those which occur in rinderpest. The omasal ulceration which was noted by Newsom and Cross (1931) was not found.

Histological section of a typical tongue ulcer revealed a necrotic epithelium heavily infiltrated with neutrophils.

FURTHER INVESTIGATION AND EXPERIMENTAL TRANSMISSION OF THE DISEASE

Swabs were taken from the oral, oesophageal and intestinal lesions, shaken up with sterile ox heart infusion broth containing 100 units of penicillin and 50 mg. of streptomycin per ml., 1 ml. being used for each swab and the washings from a number of swabs being pooled. Three different pools of the swabs of the oral lesions were prepared (see Tables III, IV, and V).

The washings were used for inoculation, by skin scarification, of lambs considered to be susceptible to contagious pustular dermatitis, the inoculum being spread with a sterile needle on a clean area about four inches square on the inside of the thigh. This area was later challenged by exposure to infection with the virus of contagious pustular dermatitis in a 1:10 suspension of desiccated scabs used for vaccine production. A similar area on the opposite thigh was exposed to infection with contagious pustular dermatitis virus at the same time, for purposes of comparison (see Tables IV and V). The temperatures of these sheep and all other sheep used in the investigation were taken twice daily for two weeks after any type of inoculation. Typical lesions of contagious pustular dermatitis were produced with washings and are described below.

Egg inoculations, using the washings, were carried out by the chorioallantoic route using 11-day chick embryos according to the method of Beveridge and Burnet (1946), but no lesions were produced.

Litters of unweaned mice aged 24 hours, 3 days and 7 days were inoculated intraperitoneally or intracerebrally with the washings and observed for any subsequent deaths up to 30 days after injection but none occurred.

Adult rabbits were inoculated intradermally with the washings in the shaved skin of the back or flanks, multiple injections of 0·1 ml. being given and the skin reactions compared with those produced by similar injections of material known to contain the virus of contagious pustular dermatitis. Hyperaemia developed, followed by discrete scab formation at both sites, the reactions being approximately equal in extent and character.

Mixed citrated blood and spleen suspension from two affected animals was inoculated into two sheep (Table II) and two serial passages of blood from these were given to further pairs of sheep at intervals of seven to nine days; the inoculated animals were examined for symptoms of blue-tongue (see Alexander, Neitz, Adelaar & Haig, 1947). The blood samples were collected in sterile bottles which contained 4 mg. crystalline sodium citrate per millilitre of blood; these were stored at 4°c till required. Spleen preparations were made as 1:5 suspensions in ox heart infusion broth and the gross cell debris removed by light centrifugation. Two affected sheep were allowed to mix with the final pair of animals which were observed for evidence of disease. Specimens of

TABLE II ATTEMPTED TRANSMISSION OF BLUE-TONGUE

Date	*Sheep No.*	*Inoculum*	*Route*	*Remarks*
12. 9.58	835	Pooled citrated blood (1 part) + 1 : 5 suspension of spleens (1 part) from two affected sheep.	i/v (10 ml.) i/d tongue (0·5 ml.)	No clinical reaction Bled 19.9.58
12. 9.58	836			No clinical reaction Bled 19.9.58
19. 9.58	837	Pooled citrated blood from sheep 835 and 836	i/v (10 ml.)	No clinical reaction Bled 29.9.58
19. 9.58	839			No clinical reaction Bled 29.9.58
6.10.58	876	Pooled citrated blood from sheep 837 and 839	i/v (10 ml.)	No clinical reaction Also placed in contact with two affected sheep for 16 days
6.10.58	879			

TABLE III ATTEMPTED TRANSMISSION OF MUCOSAL DISEASE

Date	*Animal*	*Inoculum*	*Route*	*Skin reaction*	*Remarks*
29. 9.58	Sheep 838	Pooled citrated blood from affected sheep	(*a*) i/v (10 ml.) (*b*) i/d tongue (0·3 ml.)	–ve	No clinical reaction
29. 9.58	Sheep 840	(*a*) Pooled citrated blood from affected sheep	i/v (10 ml.)		No clinical reaction
		(*b*) Pooled mouth ulcer swab suspension*	i/d tongue (0·3 ml.)	–ve	Ulcer at site of inoculation
14.10.58	Calf 1068	(*a*) Pooled citrated sheep blood	i/v (10 ml.)		No clinical reaction
		(*b*) Mouth ulcer swab suspension*	i/d tongue (1 ml.) (multiple sites)	–ve	
17.11.58	Sheep 914	Pooled spleen suspension 1 : 5	i/v (10 ml.)		No clinical reaction
17.11.58	Sheep 916		i/v (10 ml.)		Temperature 106°F on 9th day
3.12.58	Sheep 911	Citrated blood taken at temperature rise. From sheep 916	i/v (10 ml.)		No clinical reaction
3.12.58	Sheep 912		i/v (10 ml.)		No clinical reaction

i/v = intravenous i/d = intradermal * = One of three suspensions prepared from different pools (see text)

TABLE IV

DEMONSTRATION OF CONTAGIOUS PUSTULAR DERMATITIS VIRUS

Date	*Sheep No.*	*Inoculum*	*Route*	*Skin reaction (see text)*	*Remarks*
14.10.58	835	Mouth ulcer swab suspension from sheep 840 (see Table III)	Scarified skin	+++	
14.10.58	836			+++	
31.10.58	835	Challenged with known C.P.D. suspension		+	
31.10.58	836			—	
14.10.58	837	Pooled mouth ulcer swab suspension from affected sheep*		+++	
14.10.58	839			++	
31.10.58	837	Challenged with known C.P.D. suspension		—	
31.10.58	839			+	
17.11.58	914	Suspension of intestinal ulcer of affected sheep	(*a*) Scarified skin	+	
			(*b*) i/d tongue	—	
17.11.58	916		(*a*) Scarified skin	++	
			(*b*) i/d tongue	—	
31.12.58	916	Challenged with known C.P.D. suspension	Scarified skin	—	
14.10.58	875	Inoculum for Group B sheep (Table I) for C.P.D. vaccine production	Scarified skin	++++	No general reaction
14.10.58	878			++++	
28.10.58	876	Harvest scabs from Group B sheep, 1 : 10		++++	
28.10.58	879			++++	
17.12.58	915	Pooled mouth ulcer swab suspension* from affected sheep	s/c (5 ml.)		Sheep 915—Temperature 106°F on 5th day. Died 12th day
17.12.58	917				
29.12.58	956	Citrated blood taken at temperature rise from sheep 915	(*a*) i/v (5 ml.)		No clinical reaction
			(*b*) s/c (2·5 ml.)		
29.12.58	957		(*a*) i/v (5 ml.)		
			(*b*) s/c (2·5 ml.)		
31.12.58	911	Stored blood taken at temperature rise from sheep 915 pooled with suspension of spleen taken at death.	Scarified skin	—	

i/v = intravenous s/c = subcutaneous i/d = intradermal * One of three suspensions prepared from different pools (see text). C.P.D. = Contagious pustular dermatitis.

serum from 27 animals from two different outbreaks were used for the complement-fixation test for blue-tongue.

Pooled citrated blood or spleen suspensions prepared as described above from 20 affected sheep were inoculated intravenously into four sheep, and citrated blood from other similar sheep was injected intravenously into a calf, together with washings from swabs which were inoculated into the epithelium of the tongue, in an attempt to produce mucosal disease (Table III). No symptoms or lesions either of blue-tongue or mucosal disease were produced and the results of the complement-fixation test were negative.

Those sheep which died or were killed *in extremis* were examined *post mortem* and aerobic and anaerobic cultures were made on blood agar from parenchymatous organs and from areas of ulceration in the gastrointestinal tract. A variety of organisms were recovered, none consistently. *Fusiformis necrophorus* was never found.

The lesions of contagious pustular dermatitis produced on the skin of the experimental lambs were designated from ++++ (the most severe type of reaction) to +, where there was only mild pustule and scab formation. Skin sites which originally yielded reactions to experimental exposure were immune to further inoculation with the virus of contagious pustular dermatitis (Table IV). No excessive reaction was produced by scabs from animals of Group B or the sample of contagious pustular dermatitis vaccine with which they had been infected, although in this group there had been a particularly high mortality (Table I).

To investigate the effects of a different route of exposure, a suspension made from swabs from the mouth lesions from other sheep involved in the outbreak, prepared as described above, was inoculated into two sheep (Table IV). One died 12 days later from a generalized septicaemia arising from secondary infection with *Corynebacterium pyogenes* at the site of inoculation. There was no abnormal response in the second sheep. Blood subinoculated intravenously, subcutaneously and intradermally from the first into three more sheep produced no abnormal response (Table IV).

Once it had been established that the suspension prepared from swabs from lesions in the sheep from the Kent outbreak contained the virus of contagious pustular dermatitis, the animals involved in the outbreak in Berkshire were shown also to be infected with virus similar to that of the Kent disease. This was proved by the fact that animals previously exposed experimentally to contagious pustular dermatitis virus and to material from the Kent outbreak were immune on similar exposure to material from the Berkshire disease (Table V).

DISCUSSION

Although the investigations made indicate that the disease was caused by the virus of contagious pustular dermatitis, in the beginning there were grounds for suspecting that the condition might be blue-tongue. The first diagnosed outbreak of blue-tongue in Cyprus may have been connected with a recurrent undiagnosed disease of sheep characterized by stomatitis (Gambles, 1949).

TABLE V

DETERMINATION OF RELATIONSHIP BETWEEN AGENTS ISOLATED FROM DIFFERENT OUTBREAKS AND VIRUS OF CONTAGIOUS PUSTULAR DERMATITIS

Date	*Sheep No.*	*Inoculum*	*Route*	*Skin reaction*	*Remarks*
14.11.58	875	Oesophageal ulcer swab suspension from affected sheep from a Berkshire outbreak	(*a*) scarified skin	—	C.P.D. immune (see Table IV)
			(*b*) i/d tongue (0·3 ml.)	—	
	878		(*a*) scarified skin	—	C.P.D. immune (see Table IV)
			(*b*) i/d tongue (0·3 ml.)	—	
14.11.58	874		(*a*) scarified skin	++	
			(*b*) i/d tongue (0·3 ml.)	—	In 3 sites
	877		(*a*) scarified skin	++	
			(*b*) i/d tongue (0·3 ml.)	—	In 3 sites
16.12.58	875	Pooled mouth ulcer swab suspension* from affected Kent sheep	scarified skin	—	
	878			—	
16.12.58	874			—	
	877			—	

i/d = intradermal * = One of three suspensions prepared from different pools (see text). C.P.D. = contagious pustular dermatitis.

There were also features resembling mucosal disease of cattle as described by Ramsey & Chivers (1953), Schipper, Eveleth, Schumard & Richards (1955), Neilson, Hornsey, Hullard & Roe (1955), Pritchard, Taylor, Moses & Doyle (1956) in North America and Dow, Jarrett & McIntyre (1956) in this country, and Huck (1957) has described briefly the passage of bovine material through sheep and noted a rise in temperature with anorexia and diarrhoea.

A number of workers in other countries have recorded a severe form of generalized contagious pustular dermatitis in both sheep and goats.

Aynaud (1923) described a severe form involving the mouth and giving rise to an extensive stomatitis. He showed that inoculation of material from the buccal lesions on the skin of susceptible sheep resulted in a typical contagious pustular dermatitis reaction. Moussu (1923) recorded considerable mortality following secondary complications. Boughton & Hardy (1934) cite Melanidi and Stylianopoulo as reporting a 5–60 per cent mortality rate in Greece in 1928 from contagious pustular dermatitis, due to secondary involvement of the lungs and intestinal tract.

Newsom & Cross (1931) described a syndrome virtually indistinguishable from this outbreak in sheep in Kent, with a high mortality and formation of lesions in the mouth and on the tongue and hard palate. Crusts did not form but there was proliferation of the epithelial layer followed by invasion by secondary organisms and ulceration. Ulcers were sometimes extensive, particularly in the omasum, and in severe cases lesions were to be found in the rumen and reticulum and to a lesser extent in the small intestine. Miliary necrosis of the liver, circumscribed areas of bronchopneumonia and necrosis were also described. These workers considered that *F. necrophorus* was the responsible secondary agent and later reiterated this view (Newsom & Cross, 1934).

The production of typical lesions of contagious pustular dermatitis by the inoculation of material from lesions in the affected animals and the demonstration of skin immunity to contagious pustular dermatitis virus at the site of inoculation indicates that the disease described here was also a severe form of contagious pustular dermatitis. Glover (1928) showed that exposure of the skin of lambs to contagious pustular dermatitis virus by scarification gave rise to progressive local and general immunity to subsequent exposure of the skin. He failed to transmit contagious pustular dermatitis using whole blood. Both these findings are in accord with the experiments described above. The egg inoculation results agree with those of Beveridge & Burnet (1946) who had no success in adapting contagious pustular dermatitis virus to eggs. Rabbit inoculations, either with known or suspect contagious pustular dermatitis material, produced macroscopic results less marked than those obtained by Abdussalam (1957). Assistance in diagnosis might have been obtained from serum agglutination and complement-fixation tests if they had been employed (Abdussalam, 1958).

In the outbreaks of contagious pustular dermatitis described here *F. necrophorus* was not isolated, although the clinical and pathological features of the outbreaks closely approximated that described by Newsom & Cross (1931) and it may be that some other secondary factor may have enhanced the normal course of the disease.

The fact that the original lambs were being used for production of contagious pustular dermatitis vaccine was found later to be coincidental in that further lambs inspected immediately on arrival after purchase were mostly found to have healing ulcers of the tongue. This indicates that the general morbidity of this condition was in fact much more widespread, at least in the Kent area, than perhaps was realized at the time.

SUMMARY

An outbreak of a disease of sheep, characterized by multiple ulcerative or pustular eruptions in the buccal cavity, cheeks, tongue and lips and by varying extension of lesions to the gastrointestinal tract and a high mortality rate, which lasted less than two months in an acute form, is described. It was shown not to be blue-tongue or a condition related to the mucosal diseases of cattle but to be a severe form of contagious pustular dermatitis.

ACKNOWLEDGEMENTS

I am indebted to Mr. S. L. Hignett, for permitting this investigation and to Mr. J. Scarnell and Mr. D. J. Barton for their co-operation throughout.

I also wish to acknowledge the help given by my colleagues Mr. R. M. Loosmore and Mr. D. C. Ostler in providing material from comparable conditions occurring in Berkshire, and by the Director of Veterinary Services, Onderstepoort, South Africa, for arranging for complement-fixation tests on sheep sera to be carried out.

REFERENCES

ABDUSSALAM, M. (1957) *J. comp. Path.*, **67**, 305.

ABDUSSALAM, M. (1958) *J. comp. Path.*, **68**, 23.

ALEXANDER, R. A., NEITZ, W. O., ADELAAR, T. F., & HAIG, H. A. (1947) *J. S. Afr. vet med. Ass.*, **18**, 51.

AYNAUD, M. (1923) *Ann. Inst. Pasteur*, **37**, 498.

BEVERIDGE, W. I. B., & BURNET, F. M. (1946) *Spec. Rep. Ser. med. Res. Counc.* (*Lond.*), No. 256.

BOUGHTON, I. B., & HARDY, W. T. (1934) *J. Amer. vet. med. Ass.*, **85**, 150.

DOW, C., JARRETT, W. F. H., & MCINTYRE, W. I. M. (1956) *Vet. Rec.*, **68**, 620

GAMBLES, R. M. (1949) *J. comp. Path.*, **59**, 176.

GLOVER, R. E. (1928) *J. comp. Path.*, **41**, 318.

HUCK, R. A. (1957) *J. comp. Path.*, **67**, 267.

MOUSSU, G. (1923) *Rec. med. vet.*, January 15th, 5.

NEWSOM, I. E., & CROSS F. (1931) *J. Amer. vet. med. Ass.*, **78**, 539.

NEWSOM, I. E. & CROSS F. (1934) *J. Amer. vet. med. Ass.*, **84**, 233.

NIELSON, S. W., HORNSEY, F. D., HULLARD, E. J. & ROE, C. K. (1955) *Canad. J. comp. Med.*, **19**, 318.

PRITCHARD, W. R., TAYLOR, D. B., MOSES, H. E., & DOYLE, L. P. (1956) *J. Amer. vet. med. Ass.*, **128**, 1.

RAMSEY, F. K., & CHIVERS, W. H. (1953) *N. Amer. vet.*, **34**, 629.

SCHIPPER, I. A., EVELETH, D. F., SCHUMARD, R. F. & RICHARDS, S. H. (1955) *Vet. Med.*, **50**, 431, 450.

(*Received for publication* 9 *August* 1960)

Brit. vet. J. (1961), **117**, 106

STUDIES ON THE CLIMATE OF BROILER HOUSES
II. COMPARISON OF VENTILATION SYSTEMS

By C. G. Payne*
Department of Animal Husbandry, Royal Veterinary College, London

Air movement and problems associated with the causes and prevention of draughts in broiler houses have been discussed in a previous paper (Payne, 1961). The effects of various air speeds on bird distribution at different temperatures were recorded, though the ventilation rates measured in the 70 broiler houses visited in the survey were not discussed. The relationship between the design of air inlets and the air speeds which occurred at floor level were also investigated, and the importance was stressed of avoiding air velocities higher than 60 feet per minute at bird level.

Earlier reports on ventilation rates have suggested that five to eight air changes per hour provided adequate ventilation for semi-intensive poultry laying houses where the floor area per bird was three to four square feet (Hall, 1936; Haddon, 1954). However, the method whereby ventilation rates are described as air changes per hour is basically unsatisfactory for chicken houses, because there is no consideration of the cubic allowances per bird. Some of the broiler houses included in the studies reported here were 12 feet in height, but others were only six feet high. With similar floor densities in these two types of houses eight air changes in the taller house would be the equivalent ventilation per bird to 16 air changes in the lower type of house. If the semi-intensive houses mentioned by Hall (1936) and Haddon (1954) had averaged seven feet in height, eight air changes per hour would have been equivalent to 2·8–3·7 cubic feet of air per bird per minute. Cropsey (1956) and Payne (1959) both stressed the necessity for varying the ventilation rates applied to poultry houses according to the internal and external climatic conditions.

In the survey carried out from the Royal Veterinary College from 1957–1960, both fan-ventilated and naturally ventilated broiler houses were visited. Data were obtained relating to the ventilation rates applied to these different types of broiler houses, and these will be discussed here.

DESCRIPTION OF THE VENTILATION SYSTEMS

Table I describes in tabular form eleven broiler houses in which many of the data described in the present paper were obtained. All the houses except B1

* Present address: University of Nottingham School of Agriculture, Sutton Bonington, Loughborough

TABLE I
COMPARISON OF VENTILATION SYSTEMS IN ELEVEN BROILER HOUSES

House(s)	*Size (ft.)*	*Fan outlets cu. ft./ min./bird*	*Natural ridge outlets (sq. in./bird)*	*Maximum air inlet size sq. in.*	
				normal conditions	*emergency*
A3	450×57	nil	1·8	3·0	10·2
B3	96×37	nil	0·2	2·5	14·6
B1, C2, C3, F1	120×37	1·25	nil	4·3	11·8
C4, C5	140×40	nil	2·4	5·0	13·1
F2	40×37	3·0	nil	0·6	4·0
G2	230×36	2·8	nil	0·8	1·8
G3	90×30	3·3	nil	0·7	9·0

and B3 had wall insulation "U" values of 0·2–0·3 B.Th.U/ft.²/hr./°F, and roof "U" values of 0·12–0·16 B.Th.U./ft.²/hr./°F. Houses F2, G2 and G3 were windowless with hopper-type air inlets placed 4–5 feet above floor level. These hopper air inlets had exterior sheet metal hoods reaching to within one foot of ground level. Houses A3, B1, B3, C2, C3, C4, C5 and F1 were provided with windows which were used as hopper air inlets in all houses except A3. The hopper air inlets into house A3 were constructed of plywood; these were sited above the windows and immediately beneath the level of the eaves. All the houses had vapour-sealed concrete floors, except B3 where the floor was of rammed chalk, and F1 and F2 where the floors were of earth.

NATURAL AIR EXTRACTION AND THE ASSOCIATED PROBLEMS

Natural ventilation occurs because the warmed, less dense air around the animals in animal houses tends to rise towards the apices of the roofs even with calm conditions. The theoretical velocity of air flow through a natural roof extractor with no external wind is obtained from the following formula (Wooley, 1946):

$$V = 28{,}800 \sqrt{\frac{H(Ti - To)}{To + 460}}$$

Where V = Velocity of air flow in feet per hour
H = Distance in height between air inlets and air outlets
Ti = Atmospheric temperature inside building (°F)
To = Atmospheric temperature outside building (°F)

Because of friction, turbulence, and the cooling of air in extraction flues, the actual air velocity is less than the theoretical under calm conditions. Any external wind normally increases the flue extraction rate to values larger than the calculated theoretical. Wooley (1946) found that the efficiency was only 40 per cent of the theoretical figure under calm conditions.

$$\text{Thus: } V = 11{,}520 \sqrt{\frac{H(Ti - To)}{To + 460}}$$

Sainsbury and Scorgie (1955) obtained six sets of data from pig houses. In these the lowest efficiency was 48 per cent of the theoretical and this occurred in an uninsulated flue. In insulated flues the efficiency was generally nearer 60 per cent.

Sainsbury and Scorgie (1955) stressed that any natural air outlet flue must be able to cope with all the ventilation requirements independently of the aspirating force of the wind. Sainsbury (1954) found that where the air flow through an extraction flue with windy conditions was up to 700 feet per minute, under calm conditions the velocity was only 130 feet per minute. Bedford (1948) showed that the extraction rate of 24 in. cowls increased three-fold when the wind speed increased from 2–10 miles per hour. Dick (1951, 1952), experimented with human habitations and showed that the ventilation rates were affected by both windspeed and wind direction.

TABLE II
VENTILATION OUTLET FLUE VELOCITIES IN THREE NATURALLY VENTILATED BROILER HOUSES ON CALM DAYS

House	*Temperature difference between house and outside (°F)*	*Vertical height diff. air outlets above air inlets (feet)*	*Measured air velocity through the air outlets (ft./min.)*	*Theoretical air velocity due to the stack effect (ft./min.)*	*Efficiency per cent*
A3	13	12	197	264	75
C4	12	8	160	216	74
B3	25	7	192	278	69

The efficiency of the stack effect was studied under calm conditions in three houses in the present studies. Houses A1 and C4 both had continuous ridge air outlets and house B3 had four cylindrically shaped ridge extraction flues. The results given in Table II show that the air extraction velocities were 69–75 per cent of the theoretical velocity which would have occurred if there were no turbulence or resistances to air flow in the air outlets. One disadvantage of natural ventilation for broiler houses is the difficulty of maintaining constant environmental conditions, especially during winter. Although the producers attempted to maintain minimum night temperatures at 55–60°F, temperatures were recorded below 40°F, both in naturally ventilated houses and in houses where natural ventilation systems were supplemented by manually controlled fans. These extreme falls in temperature occurred when unexpected gale-force winds were recorded on winter nights. Such an instance is recorded in Fig. 1, which is a weekly thermograph chart from house C2.

Another difficulty encountered in all the naturally ventilated houses was the impossibility of maintaining the light intensities at less than 0·5 foot-candles. Such a dull lighting appeared to be necessary in order to minimize cannibalism and feather pecking during the period after brooding has ended. In the naturally ventilated houses which had blackened windows the light intensities exceeded 0·5 foot-candles and were generally 0·7–2·5 foot-candles because of light reflection through the unbaffled air inlets and outlets. In some of the windowless broiler houses the light intensities after the brooding period did not exceed 0·20 foot-candles, and were 0·05 foot-candles over much of the floor area. No ill effects were noted when such low light intensities were used, and, on average, broilers reared in the dark windowless houses were 2·05 pence per bird more profitable than broilers reared in houses with higher light intensities.

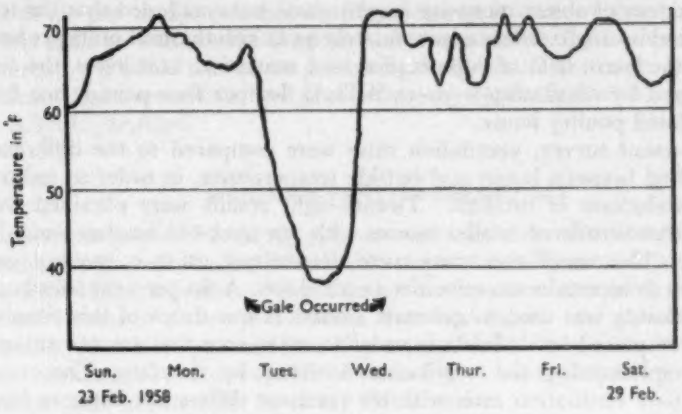


Fig. 1. Weekly thermograph record, house C2

THE ASSESSMENT OF VENTILATION RATES IN ANIMAL BUILDINGS

No direct methods are available for the measurement of ventilation rates in animal buildings where none or only part of the air extraction is accomplished by fans. Sainsbury and Scorgie (1955) have demonstrated that ventilation rates in pig houses cannot be assessed by measuring the volume of the air entering air inlets. From six sets of data they showed that only 44 per cent of the ventilation of pig houses occurred through recognizable ventilators. The remainder occurred adventitiously.

Similar results were noted in the broiler houses in the present survey. In each of two broiler houses, B1 and B3, at least six sets of data were obtained. Although only six air changes per hour were entering through known air inlets into each house, 12 air changes per hour were being extracted by the fans in house B1, and 17 air changes per hour were removed by the natural ridge outlets in house B3. The proportion of air which entered adventitiously varied from 20–81 per cent in house B1, and from 34–73 per cent in house B3. Because of such variations and discrepancies, indirect methods were used for the estimation of ventilation rates. The following formula which relates the heat produced in broiler houses with the measured temperatures and ventilation rates was calculated and applied:

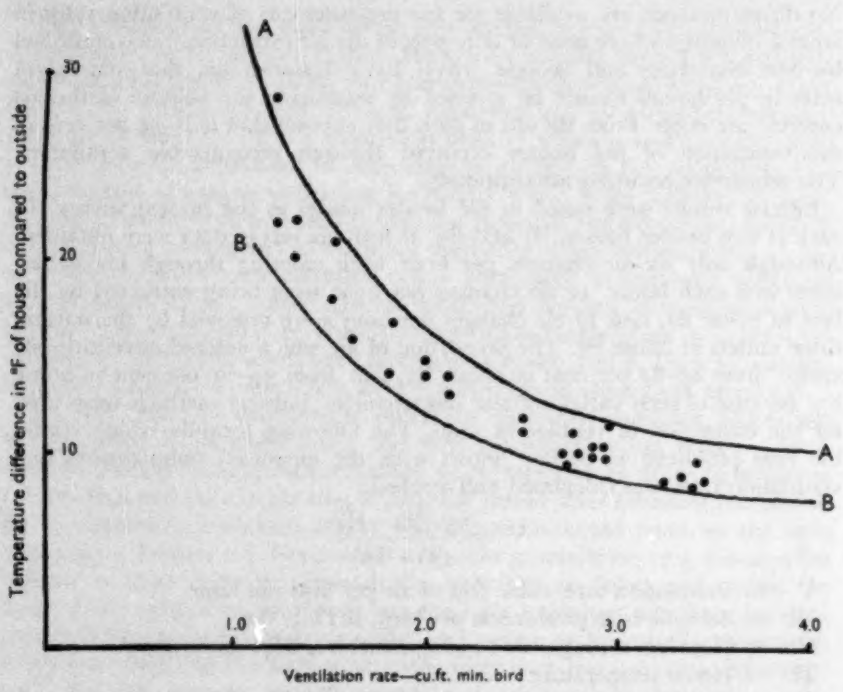
$$V = \frac{55\ (Hs - Hl)}{(Ti - To)}$$

V = Ventilation rate, cubic feet of air per bird per hour
Hs = Sensible heat production per bird, B.Th.U./hr.
Hl = Heat loss through the housing structure, B.Th.U./hr./bird
Ti = House temperature
To = Outside temperature.

Stewart and Hinkle (1959) reviewed earlier experimental investigations relating to the critical temperature and heat output of chickens. They stressed

that the majority of observations are fragmentary, but concluded that the total heat produced by a 4 lb. hen is approximately 45 British thermal units per hour. Deducting the latent heat of vaporization and structural heat losses, the heat to be removed by ventilation is 30–35 B.Th.U./hr. per four-pound hen from a well-insulated poultry house.

In the present survey, ventilation rates were compared to the differences which resulted between house and outside temperatures, in order to estimate the heat production of broilers. Twenty-eight results were obtained from windowless fan-ventilated broiler houses with ten-week-old broilers weighing 3·0–3·5 lb. The ventilation rates were determined using a moving vane anemometer to ascertain air velocities in air ducts. A 60 per cent solution of titanium chloride was used to generate smoke. A few drops of this titanium chloride were placed in air inlets in order to make sure that cross-ventilation was not supplementing the ventilation achieved by the fans. The results which compare ventilation rates with the resultant differences between house and outside temperatures are shown in Fig. 2. These show that with 3–3½ lb. broilers, house temperatures were at least 17·5°F hotter than the outside, whenever the ventilation rates were equivalent to no more than 1·5 cubic



A—A line assumes sensible heat – equals 40 B. Th. U/hr./bird. B—B line – 30 B. Th. U/hr./bird.

Fig 2. Relation between Ventilation Rate and House Temperature. Broilers 3.0 - 3.5 live weight.

feet of air per broiler per minute. House temperatures were only maintained at less than 10°F above the outside shade temperatures when ventilation rates exceeded 3·0 cubic feet of air per bird per minute. The results in Fig. 2 also indicate that the sensible heat production of 3–3½ lb. broilers is approximately 35 B.Th.U./hr./bird.

MAXIMUM VENTILATION RATES

In an earlier paper (Payne, 1959) it was stressed that broiler house temperature should not exceed the outside shade temperatures by more than 8–10°F on hot days during summer. Where house temperatures exceeded those outside by more than 10°F surveys indicated that food intake and growth rates were reduced. Thus it is apparent from Fig. 2 that broiler houses should be designed with ventilation systems capable of removing at least 3·0 cubic feet of air per bird per minute, in order to satisfy this criterion.

The fan-ventilated broiler houses which were investigated had maximum fan extraction capacities of 0·6–3·7 cubic feet of air per minute per broiler. In those houses where the fan capacities were less than 3·0 cubic feet of air per minute per broiler, efforts were made during summer on the initiative of the poultrymen to increase the ventilation rates. This involved replacing doors by wire netting and the opening of windows and other air inlets to their widest extremes. Where the fan capacities exceeded 3·0 cubic feet of air per bird per minute, the air inlets were generally hooded on the outside in order to minimize the effects of variations of outside windspeed, and also to reduce any reflected light entry. The maximum size of the air inlets was generally 0·7–1·0 square inches per bird in these windowless houses. The air extracted by 18 in. and 24 in. propellor fans was not increased by providing larger air inlets. However, in house F2 the air inlets were originally equivalent to 0·3 square inches per bird. On doubling this inlet size the air extraction of the 24 in. fan which provided the ventilation for 2,000 broilers increased from 2·5 to 3·0 cubic feet of air per minute per broiler.

THE EFFECT OF WIND SPEED ON VENTILATION RATES

In order to study the effects of wind-speed variations on ventilation rates, the relationship between wind speed and the difference in temperature between the house and outside was measured. Data from five broiler houses, including house C2 (5,000 birds) which had three 15 in. extraction fans placed in the ridge, are shown on Table III. These removed a total of 6,250 cubic feet of air per minute (1·25 cu. ft./min./bird). According to Fig. 2, this ventilation rate would have been associated with a house temperature 20–22°F higher than the outside shade temperature, when the broilers were ten weeks old. The air inlets into house C2 were equivalent to 4·3 square inches per bird, though this was increased in the second experiment to 11·8 square inches per bird by opening all doors and replacing these by one-inch mesh wire netting. Table III shows that six recordings were obtained on calm days when there

TABLE III

DIFFERENCES BETWEEN HOUSE AND OUTSIDE TEMPERATURES DURING SUMMER COMPARED WITH OUTSIDE WIND SPEED

House	*Windspeed (knots)* Nil	1–5	6–10	11–15	16–20
C2(a)	19·3±2·3 (6)	16·4±3·3 (27)	15·4±3·1 (32)	12·4±3·0 (11)	10·7±5·0 (3)
C2(b)	20·0 (1)	15·7±3·7 (10)	12·5±2·5 (27)	9·1±2·5 (20)	8·8±1·9 (8)
A3(c)	13·2±0·9 (5)	10·1±2·5 (13)	7·7±2·2 (28)	7·3±2·8 (21)	5·6±1·0 (11)
A3(d)	12·9±0·7 (5)	10·0±3·2 (36)	7·8±2·7 (40)	6·0±2·3 (23)	6·3±2·3 (6)
C5	11·2±2·8 (6)	8·5±3·2 (18)	7·1±2·9 (28)	5·7±1·8 (11)	4·5±1·6 (12)
G2	—	9·8±1·3 (5)	9·2±1·6 (16)	9·2±1·7 (14)	10·0±1·0 (3)
G3	—	9·6±2·7 (5)	8·3±2·3 (16)	7·3±1·7 (14)	8·0±1·0 (3)

Notes: The number of six-hourly records for each group is shown in brackets.
(a) 4·3 square inches of air inlet per bird
(b) 11·8 square inches of air inlet per bird
(c) First summer crop
(d) Second summer crop
Temperature differences in °F.

were 4·3 square inches of air inlets per bird into house C2 and on these occasions the house temperature averaged 19·3 ±2·3°F higher than the outside shade temperature. One record obtained when there were 11·8 square inches of air inlets per bird recorded a house temperature 20·0°F higher than outside. Thus on calm days the ventilation rates and the associated house temperatures did not appear to be affected by the size of the air inlets. Smoke tests using a 65 per cent solution of titanium chloride showed that no cross-ventilation occurred with calm outside conditions. Therefore with no external wind speed the limiting factor governing ventilation rates in a broiler house was the capacity of the air outlets.

The similarity of results obtained from two consecutive crops of broilers from house A3 is apparent in Table III. This shows that increases in wind speeds from 0–20 knots were associated with reductions in the differences in temperature between the outside and house of 6·6°F to 11·2°F in the fan-assisted and naturally ventilated houses with windows, A3, C2 and C5. The reductions

TABLE IV

EFFECT OF OUTSIDE WIND SPEED ON VENTILATION RATES DURING SUMMER

House	*Ventilation rates (calculated)* *Wind speed nil*	*Wind speed 16–20 knots*	*Calculated air inlet velocities, ft./min. no wind speed*	*Percentage increase in ventilation rates 0–(16–20) knots*
C2(a)	1·4	2·6	47	86
C2(b)	1·3	3·5	16	169
A3(c)	2·0	5·2	95	160
A3(d)	2·2	4·5	105	107
C5	2·5	6·0	71	140
G2	2·8*	3·0	509	7
G3	3·3*	3·7	687	13

Notes: * based on fan extraction capacities.
(a) 4·3 square inches of air inlet per bird
(b) 11·8 square inches of air inlet per bird
(c) First summer crop
(d) Second summer crop.
Ventilation rates calculated as cubic feet of air per bird per minute.

were less than 2·5°F in the fan-ventilated windowless broiler houses G2 and G3, where the air inlets were smaller in size than in the houses with windows, and which also had external baffles.

Table IV is calculated from data given in Fig. 2 and shows the ventilation rates which would have had to occur in order to satisfy the temperature differences recorded in Table III. Thus the ventilation rates were more than doubled through houses A3, C2 and C5 when the outside wind speed increased from calm to 16–20 knots. The initial calculated air inlet velocities with calm conditions for these three houses were 16–105 feet per minute, but because of adventitious air filtration the actual air velocities were only about one-half of these values. In the windowless fan-ventilated houses G2 and G3 the air inlets were restricted in size, and this ensured that the calculated air inlet velocities with calm conditions were 509–687 feet per minute. The actual air inlet velocities were 250–600 feet per minute. Increases in the wind speed from calm to 16–20 knots were associated with increases in the ventilation rates of approximately 10 per cent in these two windowless houses.

Air reversal through air inlets, causing some air inlets to act as outlets in the same way as occurs with cross-ventilation, was only found to occur in the present studies when the measured air inlet velocities were less than 250 feet per minute. Thus in the windowless broiler houses, with air inlet velocities through the hooded air inlets exceeding 250 feet per minute, cross-ventilation on windy days was effectively controlled. It has been shown (Payne, 1961) that positions where the air movements were higher than 50–60 feet per minute were often avoided by broilers, and this caused crowding in other areas. Thus, with high air inlet velocities, it is important that the inlet air streams are not directed or deflected towards the occupants of chicken houses, especially in winter.

SUMMARY

The ventilation systems of commercial broiler houses are discussed. Data from three naturally ventilated broiler houses showed that with calm exterior climatic conditions the outlet flue velocity due to the stack effect was nearly double that which was thought to occur.

The difficulties experienced in the measurement of ventilation rates in animal buildings are emphasized and an indirect method of measurement involving the determination of heat balance is discussed. It is suggested that maximum ventilation rates for summer equivalent to 3·0–4·0 cubic feet of air per minute per broiler are a satisfactory basis for calculating maximum ventilation requirements, in the absence of data from controlled experiments.

In windowless fan-ventilated houses, 0·6–1·0 square inches per bird of hopper-type air inlets baffled externally proved to be sufficient to satisfy these fan extraction capacities. Larger air inlets which ensured that the inlet air velocities were less than 250 feet per minute were associated with variable ventilation rates and fluctuating house temperatures because of cross-ventilation which supplemented normal ventilation air flow.

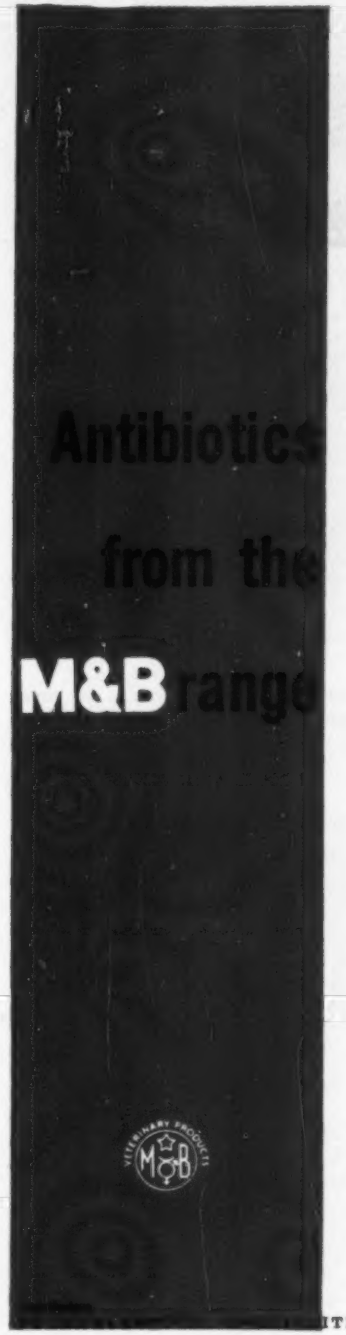
ACKNOWLEDGEMENT

The studies reported in this paper were supported by a grant from the Agricultural Research Council.

REFERENCES

BEDFORD, T. (1948). Basic principles of ventilating and heating. London: Kimpton.
CROPSEY, R. (1956). *Ore. St. Coll. Bull.*, 552
DICK, J. (1951). *J. Instn. Heat. Vent. Engrs.*, **17**, 420.
DICK, J. (1952). *J. Instn. Heat. Vent. Engrs.*, **18**, 123.
HADDON, S. G. (1954). *N.Z.J. Agric.*, **89**, 391.
HALL, J. (1936). *Harper Adams Util. Poult. J.*, **21**, 558.
PAYNE, C. G. (1959). *Agriculture (Lond.)* **65**, 629.
Payne, C. G. (1961). *Brit. vet. J.*, **117**, 36.
SAINSBURY, D. W. B. (1954). Studies on Pig Housing. Ph.D. Thesis, University of London.
SAINSBURY, D. W. B. & SCORGIE, N. J. (1955). *Brit. vet. J.*, **111**, 324.
STEWART, R. E. & HINKLE, C. N. (1959). *Agric. Engng. St. Joseph, Mich.*, **40**, 532.
WOOLEY, G. (1946). Farm Buildings. New York: McGraw-Hill.

(*Received for publication*, 9 *January*, 1961)



'STRYPEN'
trade mark *brand*

and

'STRYPEN' FORTE
trade mark *brand*

PENICILLIN AND DIHYDROSTREPTOMYCIN

INTRAMAMMARY INJECTION

Staphylococcal mastitis

PENICILLIN

Many pathogens, including staphylococci, streptococci, leptospira, clostridia

'LENTICILLIN'
trade mark *brand*

PROCAINE BENZYLPENICILLIN SUSPENSION

Moderate infections

'STRYZOLIN'
trade mark *brand*

STREPTOMYCIN SULPHATE STABILIZED INJECTION

Gram-positive and -negative infections for short intensive therapy in combination with penicillin

PENICILLIN INTRAMAMMARY INJECTION

Bovine mastitis

'ROVAMYCIN'
trade mark *brand*

SPIRAMYCIN INTRAMAMMARY INJECTION

Bovine mastitis-resistant cases

'STRINACIN'
trade mark *brand*

TRIPLE SULPHONAMIDE WITH STREPTOMYCIN

Highly suitable treatment for bacterial enteritis in all species.

Detailed information available on request

M&B *brand Veterinary Products*

Manufactured by **MAY & BAKER LTD**

VA1545/100

ITIES (MAY & BAKER) LTD · DAGENHAM

The presentation of dihydrostreptomycin and sulphadimidine in *liquid form* offers a more convenient way of giving combined systemic and local chemotherapy in scours and other intestinal disorders.

THE VETERINARY SURGEON finds that the preparation tends to control the infection more rapidly and dosage can be readily adapted to the varied needs of mixed practice.

THE FARMER appreciates the economy of accurately measured dosage and the ease with which 'Streptaquaine' Sulpha can be mixed into food.

THE SMALL ANIMAL OWNER welcomes the simple administration in teaspoonful doses and the convenience of the ready-prepared suspension.

'Streptaquaine' Sulpha

– the ready-prepared answer to **SCOURS**

Available in bottles of 16 fl. oz.
Each fluid ounce contains:

dihydrostreptomycin sulphate	0.5 G.
sulphadimidine	0.5 G.
light kaolin	6.0 G.

In liquid pectin

Write for detailed literature.

DC·B·L

THE DISTILLERS COMPANY (*Biochemicals*) LIMITED
Broadway House, The Broadway, Wimbledon, London, S.W.19
Telephone: LIBerty 6600 *Owners of the trade mark 'Streptaquaine'*

APW 5/60

Parasitic gastro-enteritis in lambs successfully treated with 'FRANTIN'

The main worm parasites responsible for gastro-enteritis in unweaned lambs in this country are *Nematodirus* spp., *Haemonchus contortus*, *Ostertagia* spp., *Cooperia* spp., and *Trichostrongylus axei*. Although Nematodirus is the most serious worm parasite of the unweaned lamb, the other worm species can also cause serious losses particularly through unthriftiness and anaemia.

'Frantin' is the only drug known to be effective against all these species. During the season regular three-weekly dosing with 'Frantin' will ensure maximum protection against nematodiriasis. Later, monthly dosing will be sufficient to maintain protection against parasitic gastro-enteritis in the unweaned lamb.

The considerable experience gained since 'Frantin' was introduced in 1958 has shown that it combines safety and efficiency and also promotes rapid weight gain by reducing the parasitic burden of unweaned lambs.

Dispersible Powder in bottles of 250 gm. (50 lamb doses)

Discovered by the Wellcome Research Laboratories

BURROUGHS WELLCOME & CO.
(The Wellcome Foundation Ltd.)

The Wellcome Building,
Euston Road, London, N.W.1. Tel: EUS 4477
and 18 Merrion Square, Dublin. Tel: 65751/2

1381

PLASMA AND BLOOD VOLUMES IN AYRSHIRE CATTLE

By R. G. Dalton and E. W. Fisher

Department of Veterinary Medicine,
University of Glasgow Veterinary School

Before the extent and significance of changes in plasma and blood volume that occur in disease or in other states can be assessed, the normal values of these two volumes in a species have to be known.

Previously, plasma and blood volumes were determined in cattle by the dilution technique using brilliant vital red, T.1824 (Evans blue), bromosulphophthalein and erythrocytes labelled with phosphorus-32. The results obtained and the methods used by different workers are summarized in Table I. This table shows the mean plasma and blood volumes expressed as ml./kg. body weight, the number of animals on which estimations were made, and details of their age, breed, weight and sex.

TABLE I
PLASMA AND BLOOD VOLUMES IN CATTLE

Reference	*Method*	*Animals*	*Plasma (ml./kg.)*	*Blood (ml./kg.)*
Turner & Herman (1931)	Vital red	54 growing dairy cows	35·0	58·1
		24 non-lactating cows	37·8	63·8
		41 lactating cows	49·2	81·1
Miller (1932)	Vital red	19 animals 81 determinations Weight range 400-1,300 lb.		59·7
Hansard Butler Comar & Hobbs (1953)	Erythocytes labelled with phosphorus-32	Hereford Cattle 2 2-6 weeks old		120
		1 3 weeks old		85
		3 2-3 months old		62
		5 6-8 months old		58
		3 14-15 months old		57
		4 8-12 years old		57
Reynolds (1953a)	T.1824	Guernsey Cattle 11 determinations on 1 heifer	36·9±0·8	52·1±1·4
		10 non-pregnant and non-lactating animals	38·8±1·4	57·4±2·1
Reynolds (1953b)	T.1824	20 pregnant animals	38·5±1·8	59·2±2·8
	T.1824	7 lactating animals	44·1±1·7	64·1±2·7
Dale, Burge & Brody (1956)	T.1824	3 dry Jerseys	36·6±3·7	62·0±5·0
		3 lactating Jerseys	47·1±4·7	68·8±7·0
		3 lactating Holsteins	54·5±5·6	84·4±9·8
Bianca (1957)	T.1824	18 determinations on 6 Ayrshire calves aged 4 months	47·5±0·8	65·4±1·1
Mixner & Robertson (1957)	Bromosulphophthalein	Holstein cattle 5 lactating cows	38·1±6·5	57·2±9·6
		9 bull calves Mean weight 48·7 kg.	68·2±16·0	115·0±30·4

From the results shown in Table I it is apparent that the values of the blood and plasma volumes, as determined by different authors, differ slightly. Differences in the estimated blood and plasma volume may be due to the different diluents used and to the method of determining the haematocrit.

It has been shown that the haematocrit in cattle may be markedly affected by the force and time at which the sample is centrifuged (Jennings, Lauder and Mulligan, 1960). These workers have found that the haematocrit value of cattle blood is fairly constant after centrifugation for 2 hours at a force of 1,600 *g* and under these conditions the trapped plasma volume is about 6 per cent.

This communication gives the haematocrit, plasma and blood volume determinations made on a number of healthy Ayrshire cattle using the dye T. 1824 (Evans blue) as the diluent.

MATERIAL AND METHODS

The haematocrit, plasma and blood volumes were determined on healthy Ayrshire bull calves and cows. The calves were aged between 1 and 3 weeks; their exact age and history immediately after birth are not known as they were purchased in a market. It is the usual practice to give such calves colostrum during the first few days of life before they are sold. The calves were kept in separate metal houses and fed twice daily from buckets on three pints of Ostermilk (Glaxo Laboratories Ltd.) (1¼ lb. powder per gallon water). None of the calves whose haematocrit, plasma and blood volumes are reported in this communication were or had been affected with diarrhoea. The cows were either healthy animals kept in the Veterinary Hospital or commercial cattle from the University dairy herd. They included some heifers, but the majority were cows in middle or late lactation. Many of the cows used were pregnant and their physical condition ranged from a "healthy leanness" to a "good fat condition."

Plasma and blood volumes were determined from the volume distribution of T.1824 and the haematocrit. The dye T.1824 (The British Drug Houses, Ltd., Poole) used in the determinations was prepared as a 0·5 or 2 per cent solution in normal physiological sterile saline. The more dilute solution was used to determine the plasma and blood volumes in the calves. A weighed amount of the dye solution was injected into the jugular vein of each animal through a fine-bore needle. Heparinized blood samples were collected by venipuncture, usually from the opposite jugular vein to that injected with the dye. Estimates of the plasma and blood volumes were usually based upon the dye concentration in the blood sample collected 10 minutes after injection of the dye, but in some animals serial blood samples were collected at intervals in order to study the equilibration and excretion of T.1824 in and from bovine plasma.

The dye concentration in test samples was found by comparison with known concentrations of the dye in the plasma or blood of the animal on which the particular determination was being made. This comparison was made using

an EEL Photoelectric X105 Colorimeter (Evans Electroselenium Limited, Harlow, Essex) with a No. 607 filter.

The plasma volume was found from the determined concentration of the dye in the plasma of the 10-minute sample and the amount of dye injected. The blood volume was found either directly from the determined concentration of dye in the blood of the 10-minute sample and the amount of dye injected, or indirectly from the plasma volume and the haematocrit using the equation:

$$\text{Blood Volume} = \frac{\text{Plasma Volume}}{100 - (\text{Haematocrit} \times 0{\cdot}94)} \times 100$$

The haematocrit was determined by centrifugation of blood samples for at least two hours at a force equivalent to approximately 1600 *g*.

RESULTS

It was found that after injection of the dye there was an initial period of mixing and thereafter the concentration of the dye in the circulation fell slowly. In Fig. 1 are illustrated the changes in dye concentration in the blood of two

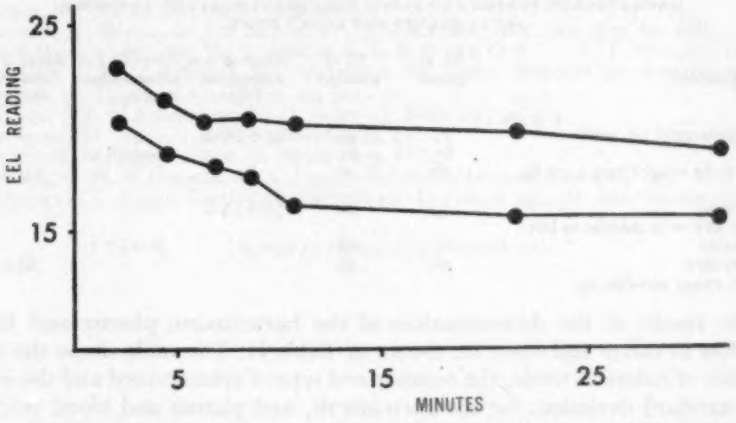


Fig. 1. Changes in concentration of T.1824 in the blood of two cows (EEL photoelectric X105 colorimeter, No. 607 filter)

cows following injection of the dye. The concentration of the dye in samples taken 10 minutes after injection was found to be very similar to that at zero time obtained by forward extrapolation of the excretion curve of the dye.

With the EEL Colorimeter and using a No. 607 filter a linear relation was obtained between the dye concentration in plasma or saline and the colorimeter readings, provided the concentration of the dye was below 20 mg./l. The relation between the dye concentration and the colorimeter reading is illustrated in Fig. 2.

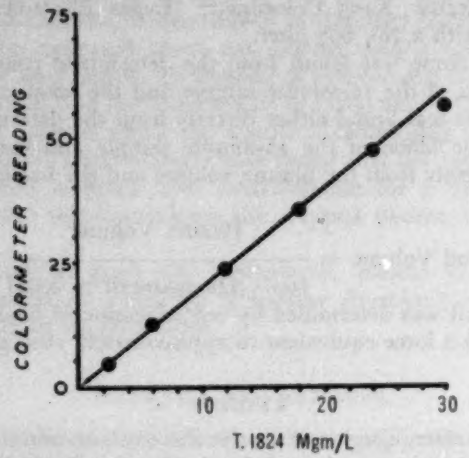


Fig. 2. Relation between concentration of T.1824 in plasma and colorimeter readings

TABLE II
HAEMATOCRIT, PLASMA AND BLOOD VOLUMES IN HEALTHY AYRSHIRE BULL CALVES AND ADULT COWS

Class of animals	*No. of animals*	*No. of estimates*	*Mean & S.D. haematocrit (%)*	*Mean & S.D. plasma volume (ml./kg.)*	*Mean & S.D. blood volume (ml./kg.)*
Bull calves aged 1-3 weeks	37	39	43·0±8·2		
	65	67		66·0±8·7	
Mean body weight 33·4±4·5 kg.	38	40			110±20
Adult cows	15	26	33·0±3·8		
Mainly dry or in middle to late lactation	28	38		50·0±7·7	
Some heifers	28	36			63±8·3
Weight range 200-600 kg.					

The results of the determinations of the haematocrit, plasma and blood volumes in calves and cows are shown in Table II. The table shows the total number of estimates made, the number and type of animals used and the mean and standard deviations for the haematocrit, and plasma and blood volumes expressed as ml./kg. body weight. It will be noticed from the results shown in Table II that the plasma volumes only were estimated on some animals and the haematocrit was not determined, hence it was not always possible to calculate the blood volume.

DISCUSSION

Comparison of the results shown in Tables I and II indicates that the mean plasma and blood volumes determined in this study were similar to those obtained by previous workers. Differences between our results and those obtained by others can probably be attributed to the methods of determining the haematocrits and the different diluents used. The mean haematocrit,

plasma and blood volumes were significantly higher in calves (at the 0·1, 0·1, and 0·1 per cent levels, respectively) than the corresponding mean values obtained in adult cattle. Similar differences in the haematocrit, plasma and blood volumes have been shown to occur in the human subject (Wiggers, 1949).

SUMMARY

The haematocrit, plasma and blood volume values of normal Ayrshire cattle were determined by the dilution technique using the dye T. 1824 (Evans blue).

ACKNOWLEDGEMENTS

This study was made with financial assistance from the Agricultural Research Council. The authors would like to acknowledge the technical assistance in this study of Miss Helen Peden and Mr. James Gillespie.

REFERENCES

Bianca, W. (1957). *Brit. vet. J.*, **113**, 227.
Dale, H. E., Burge, G. J. & Brody, S. (1956) *Res. Bull. Mo. Agric. Exp. Sta.* 608.
Hansard, S. L., Butler, W. O., Comar, C. L. & Hobbs, C. S. (1953). *J. Anim. Sci.*, **12**, 402.
Jennings, F. W., Lauder, I. M., Mulligan, W. (1960). Personal communication.
Miller, W. T. (1932). *Cornell Vet.*, **22**, 320.
Mixner, J. P. & Robertson, W. G. (1957). *J. Dairy Sci.*, **40**, 914.
Reynolds, M. (1953a). *Amer. J. Physiol.*, **173**, 421.
Reynolds, M. (1953b). *Amer. J. Physiol.*, **175**, 118.
Turner, C. W. & Herman, H. A. (1931). *Res. Bull. Mo. Agric. Exp. Sta.*, 159.
Wiggers, C. J. (1949). Physiology in Health and Disease, p. 391, 5th Edn. London: Kimpton.

(*Received for publication*, 13 *December* 1960)

Brit. vet. J. (1961), 117, 120

THE PUBERTAL CHANGE IN THE GROWTH CURVE FOR MICE AND THE CORRESPONDING RATES OF LOSS OF HEAT

By A. E. Hawkins
Department of Physiology, Royal Veterinary College, London

In the study of the effects of disease or of stimulants or depressants on the metabolism of mice, the restless nature of mice makes it difficult to satisfy the conditions of the basal state. These conditions are that the body be in complete mental and physical repose, in the post-absorptive state and in a "comfortable" environment (Hawk, Oser & Summerson, 1947). It has even been found difficult to obtain the rate of oxygen consumption of mice in a resting state, that is when still, but not asleep and not post-absorptive (Harvey, 1958). Preliminary experiments indicated that the measurement of the rate of loss of heat of mice taken straight from their cages and placed in an environmental temperature within the zone of thermal neutrality might be an alternative and reproducible technique which would avoid the difficulties encountered in the methods designed for basal studies. It was essential, however, to establish whether there was any advantage to be gained by working with mice of a particular age or weight and also to determine the most suitable activity state to use for comparison purposes.

The results of three hundred experiments on the rate of loss of heat of resting albino mice when plotted as the logarithm of the rate of loss of heat against the logarithm of the body weight revealed a change of slope in the curve in the region of $\log_{10}$ weight = 1·25 (Clarke & Hawkins, 1958). A straight line drawn through the points prior to the change of slope had a slope of approximately 0·75, whereas a straight line through the other points had a slope of less than 0·2. This suggested that there would be considerable advantage in using mice of a greater weight than that corresponding to the point in the curve where the change of slope occurred.

$\log_{10}$ weight = 1·25 represents a body weight of 18 g. and the albino mice used in the experiments attained this weight at a postnatal age of approximately 35 days, an age at which puberty in albino mice has been reported (Parkes, 1925; Engle & Rosasco, 1927). (Puberty in connection with rodents appears in the literature as the equivalent of the menarche in man and is so used in this communication.) The change of slope was of a similar kind to those found by Kibler & Brody (1942) when they plotted the total metabolism of resting albino rats (as measured by oxygen consumption) against body weight on logarithmic paper. Kibler & Brody supposed that the changes in slope were connected with an alteration in the growth rate. All occurred before the pubertal change in the growth curve of rats.

In view of these differences and because of the improvements in experimental technique it was decided to repeat the experiments using two strains of mice. It has been pointed out (McLaren & Michie, 1954; Biggers & Claringbold, 1954) that the use of inbred lines in biological experimentation may give poorer uniformity than the use of random-bred mice, so mongrel grey and inbred albino (T.O. strain) mice were used.

METHODS

Litters of both grey and albino mice were kept at a constant ambient temperature of 20°C with food (diet No. 41B, Bruce & Parkes, 1949) and water *ad libitum*. The litters were weighed at intervals from a postnatal age of 14 days, and vaginal smears were taken every day from a postnatal age of 30 days, that is as the mice approached the age at which the first oestrus was to be expected.

Measurements of the rate of loss of heat were made with an ambient temperature between 28° and 32°, that is, within the limits of thermoneutrality for mice given by Benedict & Fox (1933), although Herrington (1940, 1941) restricts this range to 31° to 32°. Measurements were made of the rate of loss of heat in the following states: "resting", "moving head", "locomotion" and "grooming". Some of these measurements were made with the manually operated calorimeter described by Clarke & Hawkins (1956), and some with an automatic apparatus of the same type (Hawkins, 1958). In these calorimeters the rate of loss of heat is continually balanced by the known heat dissipated from an electrically heated coil. A continuous record can be obtained and the average value for the rate of loss of heat at any chosen level of activity can be calculated at the end of each experiment. The duration of each experiment was between 25 and 60 minutes. One hundred and twenty experiments were carried out with grey mice and 60 with the albinos.

RESULTS

In Fig. 1 the logarithm of the average weight in grams of the mice in a litter is plotted against the logarithm of the postnatal age in days. Best straight lines have been drawn by eye for an albino and a grey litter solely in order to draw attention to the region where the rate of growth changes. This restriction is necessary because (a) the statistical methods for dealing with a relation between two variables are not very satisfactory unless there are *a priori* grounds for choosing a certain relationship (see, e.g., Brownlee, 1949); (b) Davenport (1934) and others (e.g. Medawar, 1950; Yates 1950) have pointed out that a mass-curve of growth is altered by curves of distribution, that is that a growth curve constructed by averaging all individuals of a given age will not show, for example, a sudden change in growth rate if this occurs at different ages in different individuals, but only a smooth transition from one growth rate to the other; (c) Robertson (1916, 1926) and others (see, e.g., Backman, 1939) have found that the mass-curve of growth for mice is sigmoid. There is a change in the growth rate of the albino mice and of the grey mice at an age of approximately 35 days ($\log_{10} 35 = 1{\cdot}54$) and 41 days ($\log_{10} 41 = 1{\cdot}61$) respectively. The average litter weights were reasonably consistent at

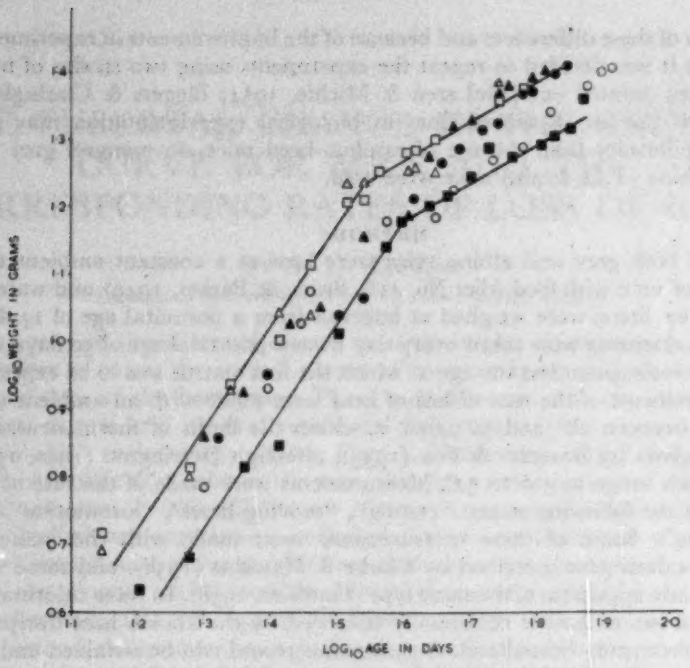


Fig. 1. Logarithm of the average weight of mice in a litter plotted against the logarithm of the post-natal age. Albino: ○=7 in litter; △=8 in litter; □=10 in litter. Grey: ●=4 in litter; ▲=6 in litter; ■=8 in litter.

these ages, being 16 g. for albino mice at 35 days and 15 g. for grey mice at 41 days.

In Fig. 2 the logarithm of the rate of loss of heat in kilocalories per day is plotted against the logarithm of the body weight in grams for both the albino and the grey mice for the four states of activity considered. As in Fig. 1 the straight lines have been drawn by eye solely to illustrate the trend of the curve and no deductions should be made from the straight lines. In fact, in all four cases, if a linear relation is assumed between $\log_{10}$ (rate of loss of heat) and $\log_{10}$ (body weight) the correlation coefficient is greater than 0·9, indicating a relatively high degree of correlation since a perfect functional relationship is represented by unity.

The scatter of results was not found to be consistent and standard deviations were high, being of the order of 5–10 per cent. A rather wide scatter of results would appear to be inevitable since some mice, for example, invariably groom themselves more vigorously than others. No particular state of activity provided results with consistently lower deviations at all weights, but "locomotion" was often the best in this connection. This particular state of activity was observed in nearly every experiment; therefore if "locomotion" is chosen as the activity for comparison purposes few experiments will be wasted.

DISCUSSION

It has been shown by several workers that there is a change in the growth rate of mice which coincides with the epoch of puberty (see, e.g., Thompson, 1948). The changes in growth rate found in this work occurred at postnatal ages of approximately 35 and 41 days with the albino and grey mice respectively. That these changes coincided with the occurrence of puberty is suggested both by reference to the literature and by direct observation. Parkes (1925) found male sperm present at about 35 days and Engle & Rosasco (1927) found that the median for the opening of the vaginal orifice and for vaginal smears showing first oestrus was the 35th day, both experiments being with albino mice. Mirskaia & Crew (1930*b*,*c*) found the mean ages at first oestrus to be 39 days for albino and 52 days for coloured mice. In this work the vaginal smear showing a first oestrus at the earliest age was from an albino mouse at the 35th day and the earliest litter was again from an albino at the 63rd day. The earliest vaginal smear showing oestrus obtained with the grey mice was at the 44th day and the earliest litter was at the 72nd day. The gestation period for the mouse is given as 19–20 days by Parkes (1926) and by Mirskaia & Crew (1930*a*) and was confirmed for the albino mice used in these experiments (Hawkins, 1959). Thus the earliest ages at which parturition occurred presupposes an oestrus, not necessarily the first, at the ages of 43 and 52 days for albino and grey mice respectively.

Since the average weights of the two strains of mice at the supposed pubertal change in growth rate are so close (15 and 16 g.) it is to be expected that the curves resulting from plotting the logarithm of the rate of loss of heat against the logarithm of the weight will show a change in slope, if such a change occurs, at the same weight for both strains of mice. So far as can be judged, this is so. With "resting" mice there is no apparent change in slope. The trend or regression line, calculated by the method of least squares, had a slope of 0·73 with a correlation coefficient of 0·97. In the three other cases there is an apparent change of slope with possible plateaux in the region of $\log_{10}$ weight = 1·20.

It is reasonable to suppose that the short plateaux in the curves, if they exist, represent the fact that the mice do not all achieve puberty at the same age. It follows that if the average value of the abscissae of the plateau be calculated it should correspond with the ordinate value obtained from the growth curve at the region of the pubertal change in growth rate. The agreement is satisfactory since $\log_{10}15 = 1{\cdot}18$ and $\log_{10}16 = 1{\cdot}20$.

It can thus be said that, with the two strains of mice examined here, the change in growth rate at puberty was accompanied by a change in the relation between the rate of loss of heat and the weight of the mouse in activity states other than that of rest. This is reasonable since a change in the relation for the resting state must imply a change in the ratio of physiological surface area to volume since there is no evidence of a change in body temperature. A change in the relation for any other state of activity need imply only a change in the vigour of the particular activity with increasing age or weight.

As already mentioned, the original experiments by Clarke & Hawkins

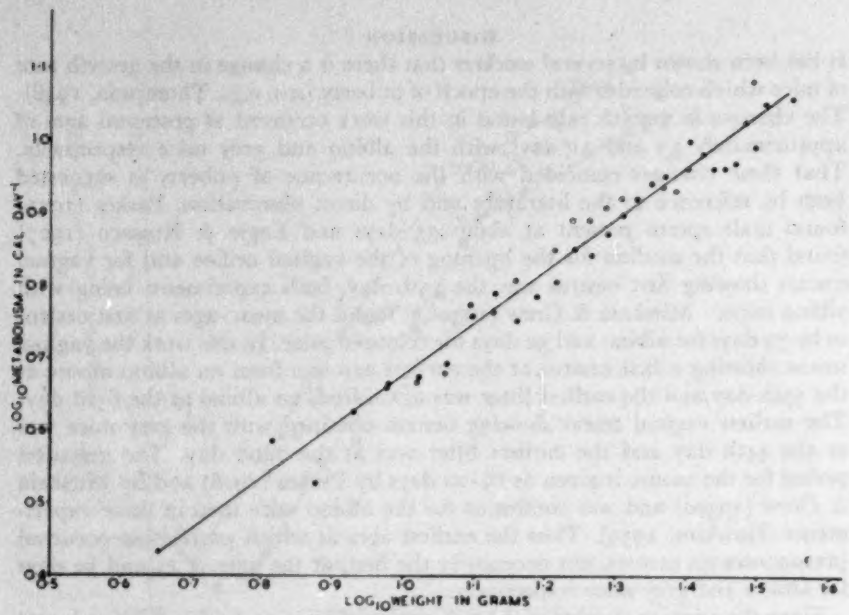

LOG10METABOLISM IN CAL. DAY-1
LOG10WEIGHT IN GRAMS

Fig. 2(a)

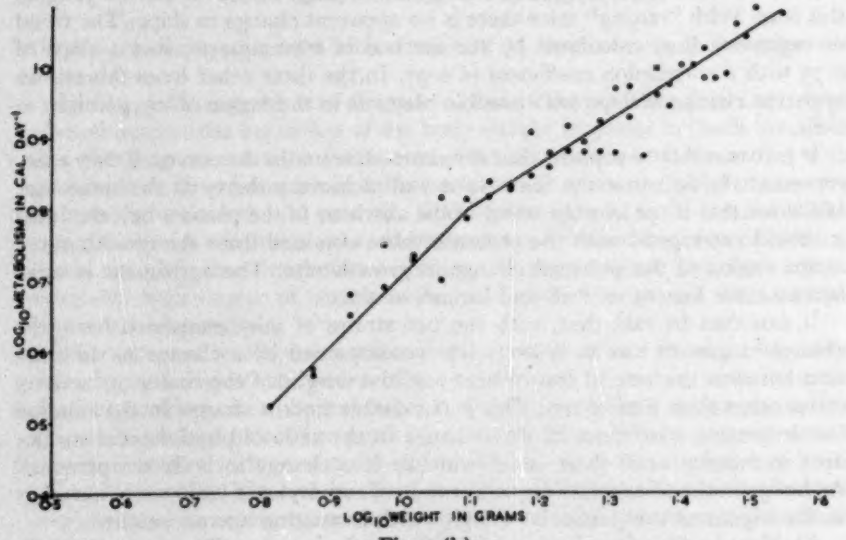

LOG10METABOLISM IN CAL. DAY-1
LOG10WEIGHT IN GRAMS

Fig. 2(b)

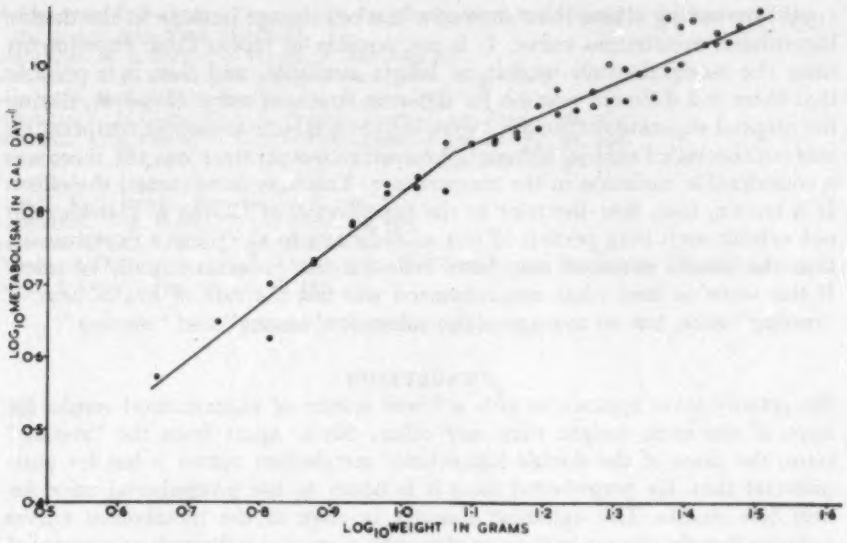


Fig. 2(c)

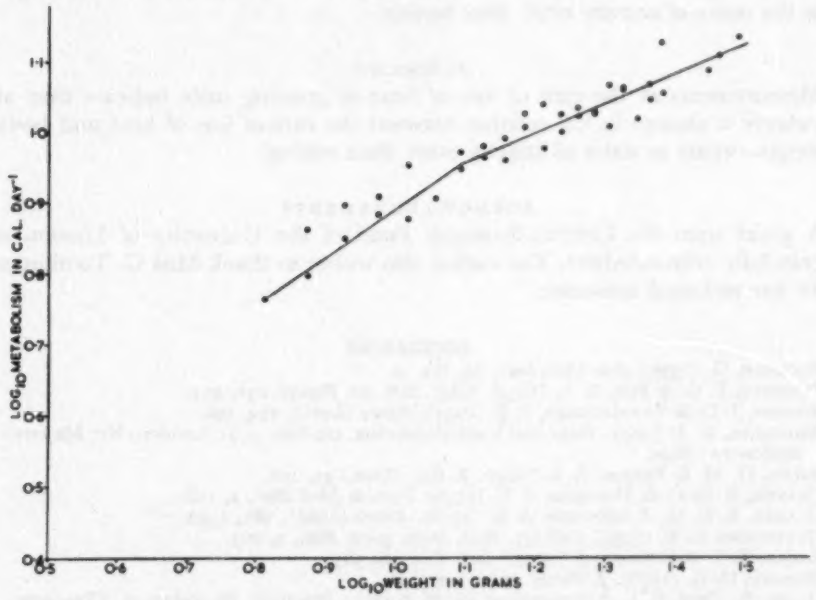


Fig. 2(d)

Fig. 2. Logarithm of the rate of loss of heat plotted against the logarithm of the weight for mice in four states of activity. ○=albino; ●=grey.
(a) resting; (b) movement of head; (c) locomotion; (d) grooming.

(1958) on resting albino mice showed a marked change in slope of the double logarithmic metabolism curve. It is not possible to repeat those experiments since the mongrel strain used is no longer available, and thus it is possible that there is a different relation for different strains of mice. However, during the original experiments the mice were kept in a laboratory whose temperature was not controlled so that, although the average temperature was 18°, there was a considerable variation in the temperature. This may have caused the effect. It is known, also, that the mice in the experiments of Clarke & Hawkins did not exhibit such long periods of rest as did those in the present experiments, thus the results obtained may have reflected the previous activity of mice. If this were so then what was measured was not the rate of loss of heat of "resting" mice, but an average of the values for "resting" and "moving".

CONCLUSION

No activity state appears to give a lower scatter of experimental results for mice of the same weight than any other. Since, apart from the "resting" state, the slope of the double logarithmic metabolism curves is less for post-pubertal than for prepubertal mice it is better to use postpubertal mice for heat loss studies. The apparent changes in slope of the metabolism curves indicate that the change in the rate of growth of mice at puberty is accompanied by a change in the relation between the rate of loss of heat and body weight in the states of activity other than resting.

SUMMARY

Measurements of the rate of loss of heat of growing mice indicate that at puberty a change in the relation between the rate of loss of heat and body weight occurs in states of activity other than resting.

ACKNOWLEDGEMENTS

A grant from the Central Research Fund of the University of London is gratefully acknowledged. The author also wishes to thank Miss G. Tomlinson for her technical assistance.

REFERENCES

Backman, G. (1939). *Acta Univ. lund.*, **35**, No. 12.
Benedict, F. G. & Fox, E. L. (1933). *Pflüg. Arch. ges. Physiol.* **231**, 455.
Biggers, J. D. & Claringbold, P. J. (1954). *Nature (Lond.)*, **174**, 596.
Brownlee, K. A. (1949). Industrial Experimentation, 4th Edn. p. 61. London: Her Majesty's Stationery Office.
Bruce, H. M. & Parkes, A. S. (1949). *J. Hyg. (Lond.)* **47**, 202.
Clarke, E. G. C. & Hawkins, A. E. (1956). *Phys. in Med. Biol.*, **1**, 118.
Clarke, E. G. C., & Hawkins, A. E. (1958). *Nature (Lond.)*, **181**, 1599.
Davenport, C. B. (1934). *Cold Spr. Harb. Symp. quant. Biol.*, **2**, 203.
Engle, E. T. & Rosasco, J. (1927). *Anat. Rec.*, **36**, 383.
Harvey, D. G. (1958). *J. Pharm. (Lond.)*, **10**, 483.
Hawk, P., Oser, B. L. & Summerson, W. H. (1954). Practical Physiological Chemistry. p. 733, 13th Edn. London: Churchill.
Hawkins, A. E. (1958). *J. sci. Instrum.*, **35**, 440.
Hawkins, A. E. (1959). *Lab. Pract.* **8**, 339.
Herrington, L. P. (1940). *Amer. J. Physiol.*, **129**, 123.

HERRINGTON, L. P. (1941). Temperature. Its Measurement and Control in Science and Industry. p. 446. New York: Reinhold.
KIBLER, H. H. & BRODY, S. (1942). *J. Nutr.*, **24**, 461.
MCLAREN, A. & MICHIE, D. (1954). *Nature (Lond.)*, **173**, 686.
MEDAWAR, P. B. (1950). *Proc. roy. Soc. B.*, **137**, 474.
MIRSKAIA, L. & CREW, F. A. E. (1930*a*). *Quart. J. exp. Physiol.*, **20**, 263.
MIRSKAIA, L. & CREW, F. A. E. (1930*b*). *Quart. J. exp. Physiol.*, **20**, 299.
MIRSKAIA, L. & CREW, F. A. E. (1930*c*). *Proc. roy. Soc. Edinb.B*, **50**, 179.
PARKES, A. S. (1925). *J. roy. micr. Soc.*, 315.
PARKES, A. S. (1926). *Proc. roy. Soc. B*, **100**, 151.
ROBERTSON, T. B. (1916). *J. biol. Chem.*, **24**, 363.
ROBERTSON, T. B. (1926). *J. gen. Physiol.*, **8**, 463.
THOMPSON, D'ARCY, W. (1948). On Growth and Form, p. 161. Cambridge University Press.
YATES, F. (1950). *Proc. roy. Soc. B*, **137**, 479.

(*Received for publication*, 9 *January* 1961)

Brit. vet. J. (1961), **117**, 128

THE DUTIES OF A VETERINARY SURGEON AT A RACE MEETING

By Horace Bell
Maidenhead, Berks.

A veterinary surgeon attending a race-meeting for the first time to undertake race-course duties may find what goes on a little disconcerting until he becomes *au fait* with what is expected of him. The purpose of this paper is not so much to discuss the technical aspects of the veterinary work which he may be called upon to carry out, because in the main these will present the same kind of problems as confront him from day to day in his own practice, but rather to give him some idea of the general nature of his duties and his relationship with other officials at the meeting.

Whether the meeting is under Jockey Club Rules, i.e. flat racing, or under National Hunt Rules (steeplechasing), there will be three Stewards, who are chosen for their integrity and knowledge of racing and whose function is to adjudicate in all disputes and see that the meeting is run according to the rules of racing. Their position is purely honorary. In attendance on the Stewards there is usually a Stewards' Secretary, a paid official whose function is to advise in matters appertaining to the rules, to assist in conducting enquiries, etc.

The Stewards watch the race from the Stewards' Box. Should the veterinary surgeon during the course of his duties have to be in the box, he should stay in the background where he will not obscure the view of the Stewards, who for obvious reasons must see all that takes place.

The Clerk of the Course is the person responsible for everything on a race-course and it is to him that the veterinary surgeon should report on arrival at the course. It is advisable to arrive an hour before the first race for, though the services of the veterinary surgeon are not usually required till racing begins, if he does this he will have time to inspect the ambulance and transport for removal of a dead animal and to ascertain how he can contact them should the waving of an orange flag on some part of the course indicate that a veterinary surgeon's services are required at that spot. It is also important for him to know how he is to proceed to the scene of an accident—whether a car is to be provided by the racing executive, or whether he is to use his own, and in any case where his vehicle is to stand.

There are usually two veterinary surgeons on duty at a steeplechase meeting and for convenience one may undertake duties in one sector, and the other in another sector. One of them may operate from the centre of the course; this has the advantage that he can often reach the scene of an accident without having to drive on the course, a procedure which is not permitted till the race is over and the horses have returned to the paddock. If an accident should occur on a sector of the course which has to be traversed by the horses a second

time and it is not possible to move a fallen horse, there should be a man at hand to warn the jockeys by a red flag that they must avoid the animal on the ground. (The red flag is very soon to be superseded by a black and white board.)

If it is evident that an injured animal must be destroyed, then unless the injuries are of such a nature as to call for instant destruction, the veterinary surgeon should await the arrival of the owner or trainer and receive sanction from one of them. If neither is available and destruction is imperative the veterinary surgeon must receive the sanction of a police officer—that is the law today. If first-aid treatment is called for it may be carried out on the spot or the horse may be conveyed by ambulance or walked to the loose-box provided for such cases.

The veterinary surgeon's equipment should include a humane killer, of a type which is as nearly fool-proof as possible. There are several patterns but probably the Greener type which is fired when the cap is struck with a mallet is the least likely to give trouble. If the veterinary surgeon elects to shoot a horse himself rather than leave it to the horse-slaughterer, he should place the humane killer firmly on the head of the animal within half an inch of the peak of the mane where it extends downwards from between the ears. This will ensure that the bullet penetrates the brain and cord. Many horses are shot lower down on the forehead and though they fall and die there is an unnecessary spilling of blood.

Race-course rules now require that canvas screens be provided, behind which shooting and loading of the carcass must be carried out. These screens are carried on the vehicle provided for removing dead animals and should be checked by the veterinary surgeon at his inspection before racing begins.

Before destroying an animal it is advisable to see that spectators are directed to stand behind or as far to the sides as possible for it has been known for a spectator to be struck by a ricochet.

It is also advisable, before destroying an animal, to ascertain whether it is insured. A trainer will very often wish a horse to be destroyed when it is evident to him that the animal is unlikely to be of further value as a race-horse. Unless the veterinary surgeon can justify destruction on humane grounds, the certificate which may later be required of him by the insurance company may cause him some embarrassment.

After the destruction of a horse the veterinary surgeon should proceed to the weighing room and report the matter to the Clerk of the Scales. Indeed it is advisable to keep this official informed of all that has taken place in connection with an injured animal because it is part of his duty to record all that takes place on the race-course. After a race it is a good practice for the veterinary surgeon to go to the weighing-room and stay near the Clerk of the Scales for a time, because if a trainer should require the services of the veterinary surgeon it is to the Clerk of the Scales he will apply.

As has been stated already, a veterinary surgeon at a race-course will advise and deal with accidents much as he would in his own practice, but for the most part he will be dealing with another man's clients. Where feasible he should therefore advise that the animal be taken home as quickly as possible

so that treatment can be undertaken by the owner's own veterinary surgeon. Fundamentally the veterinary surgeon's function at a race-course is to help to keep the course clear by dealing rapidly with accidents and to render first-aid when necessary. Such treatment as administration of tetanus antiserum should be left to the owner's veterinary surgeon and in most cases can safely be left till the animal gets home. Where it seems advisable to carry out such treatment, for example when the animal has come a long distance and is not likely to be home for several days, it is well to inform the trainer beforehand that the cost of the treatment is not borne by the racing executive (unless there is an arrangement to that effect—this can be ascertained from the Clerk of the Course) but must be paid to the veterinary surgeon carrying out the treatment.

The opinion of the veterinary surgeon may also at times be sought on matters not connected with accidents. The Stewards may wish a horse which appears lame in the parade ring to be examined as to its fitness to run. In nine cases out of ten such an animal will show no sign of lameness if taken out and trotted. The Stewards may perhaps wish to know whether a horse is suffering from ringworm or, if it has been, whether the lesions are still infective. Such questions are usually left to the Jockey Club or National Hunt veterinary surgeon to decide. Experienced trainers will not as a rule bring an animal affected with ringworm to a race-course without being able to produce a certificate from their own veterinary surgeon to the effect that the lesions are not infective. In this case, unless the veterinary surgeon consulted at the race-course has very strong grounds for doing so, he would be ill-advised to disagree with the certificate. In examining cases not covered by certificates where there is an element of doubt, he should be cautious in his judgment, remembering that if he makes a positive diagnosis the trainer is likely to be heavily fined.

Many race-courses now require a veterinary surgeon to be present at the start so that he may decide whether a horse is fit to run after it has been kicked. To see when an animal has been kicked, the best place to stand is probably in the middle of the course behind the horses. Should a horse receive a full-blooded kick on some part of a limb not well covered by muscle, however well the animal seems, the veterinary surgeon should not forget the possibility of a depressed fracture and, if consulted by the Starter, should think well before letting it run.

The equipment needed, apart from the humane killer, has not been discussed because it seems obvious that much the same outfit is required as in ordinary practice. Clothing which will provide suitable protection against inclement weather is, however, essential, because races are often run in pouring rain and naturally attention to an accident cannot wait until the weather clears.

Finally it should be said that in veterinary matters on the race-course the veterinary surgeon must be the final arbiter. He is not likely to suffer interference from racing officials; the only concern of the Clerk of the Course will be to know that the veterinary surgeon gets to the scene of an accident promptly and indeed one of the greatest attributes a race-course veterinary surgeon can have is that of being on the spot when required.

(*Received for publication*, 21 *December*, 1960)

Sparine

offers a new approach to animal control

1 *It quietens without stupefaction or hypnosis.*

2 *It substitutes safe, effective chemical restraint for physical force.*

3 *It does not produce "spontaneous muscular agitation" when the drug effect wears off.*

Sparine* is a new, selective type of sedative that leaves animals quietened but co-operative.
Write for detailed information on the use of Sparine in small and large animal practice.

**trade mark*

Solution for injection
Boxes of 10 x 2 ml. (100 mg. promazine hydrochloride) ampoules.
10 ml. multi-dose vials (50 mg. per ml.).
30 ml. multi-dose vials (50 mg. per ml.).

John Wyeth & Brother Limited, Clifton House, Euston Road, London, N.W.1.
Sp/V/1

D**

now combined in the ONE VIAL

'DISTAVONE'

SUSPENSION VETERINARY

Procaine penicillin combined with dihydrostreptomycin

THE DISTILLERS COMPANY (Biochemicals) LIMITED

PENICILLIN

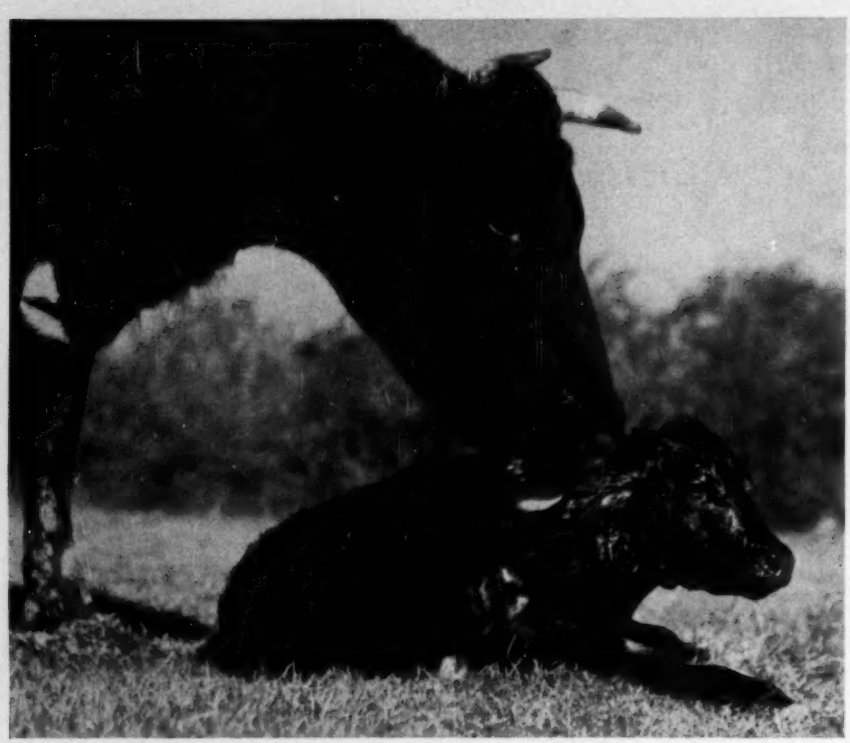
STREPTOMYCIN

Ready-prepared

Available in 25 ml. vial
and the NEW 75 ml. vial

Broadway House, The Broadway, Wimbledon, London, S.W.19 Tel: LIBerty 6600

Owners of the trade mark 'Distavone'



'HIBITANE' PESSARIES for better uterine hygiene and reliability in the treatment of post-partum infection

For the prevention and treatment of uterine infection more and more veterinary surgeons are finding that 'Hibitane' Pessaries give results far superior to those obtained with penicillin, the sulphonamides and other standard methods.

Hibitane PESSARIES
(chlorhexidine) TRADE MARK

Containers of 6 and 48 pessaries

- **High activity** against Gram-negative and Gram-positive organisms and *Trichomonas foetus*. Bacteria do not develop resistance to 'Hibitane'.
- **Persistency.** Antibacterial activity is retained in the presence of blood, pus and uterine fluids. The low solubility of the 'Hibitane' ensures prolonged action.
- **Excellent dispersion** of the active agent in the uterus. The effervescent action of the pessaries spreads 'Hibitane' through the uterine fluids and over all the surface within the cavity.
- **Physical cleansing.** The effervescence of the pessary within the uterus converts the fluid contents into a bulky mass of foam and this physically removes infected material.
- **Low toxicity.** 'Hibitane' does not inhibit phagocytosis, and bull spermatozoa are unaffected by normal concentrations. Experimental doses of as much as 20 g. have been placed in the uterus of cattle with no harmful effect.

Ph.35

ICI
IMPERIAL CHEMICAL INDUSTRIES LTD.
Pharmaceuticals Division Wilmslow Cheshire

BOOK REVIEWS

Poultry Breeding. By G. E. MANN. 3rd edn. pp. 146. Bulletin No. 146, Ministry of Agriculture, Fisheries and Food. London: H.M.S.O. Price 7s.

This bulletin dealing with problems associated with poultry breeding is longer and more comprehensive than some of the other Ministry of Agriculture bulletins. Except for variations in the order of presentation there are few changes from the second edition published in 1955. However, the modern systems of breeding which utilize "hybrid vigour" are more fully described.

For the non-scientist the laws of Mendelian inheritance are given as an introduction, for which the glossary of genetical terms is most useful. The physical basis for heredity, poultry genetics and the inheritance of breed characteristics take up nearly one half of the presentation. These subjects are discussed in such considerable detail that the book may be recommended to students of poultry husbandry as a textbook of breeding principles. Unfortunately, the sources of reference data, although quoted in the text, are not listed in a bibliography.

Each of the economic factors involved in the selection of breeding stock, especially for high egg production, is discussed at length. This should prove of value to the smaller independent breeders, particularly for reference.

One omission is the importance or otherwise of blood grouping in poultry improvement. However, this appears to be only of practical importance to the larger scale hatcheries. Many of the tables and data tend to be very cramped and abridged. This leads to visual interpretation becoming unnecessarily difficult. In some instances the chapter headings printed at the top of each page are easily confused with unheaded tables and figures. In spite of these shortcomings, the book is a most useful reference for poultry breeders and students of animal breeding.

C. G. PAYNE

Animal Husbandry Heresies. By ALLAN FRASER. London: Crosby Lockwood. Price 16s.

The author is an agricultural scientist who has long been noted for his forthright criticism of many aspects of current agricultural practices. In this, his latest book, written in his own inimitable style, the great Bakewell, the breed societies and the agricultural scientists are all subjected to the withering fire of his pen. However, the author does appear to be favourably impressed by many of the achievements of traditional husbandry and by that somewhat mystic quality, "the stockman's instinct".

Perhaps Fraser does not prove heresies—indeed the book suggests on one or two occasions that the author himself may be the heretic—but he does show that many of the accepted beliefs of agricultural scientists and of leading agricultural bodies have grave limitations.

When one considers the tremendous achievements of the combination of agricultural science and practice, and that the limitations of scientific meth[illegible]ds

referred to by Fraser have been demonstrated by scientists, one feels that the criticism is somewhat lacking in objectivity. Some of the statements, such as "a parade of test tubes containing their semen would give as much and possibly more information of genuine utility" [than a parade of dairy bulls], are perhaps extreme but nevertheless pertinent and stimulating.

While this book is certainly controversial and should result in self-examination in many quarters it also gives an account of many of the recent advances in the science of animal husbandry.

I can recommend this book to all those interested in animal husbandry; veterinary surgeons and students will find it well worth reading as it touches upon so many aspects which have a bearing on their everyday work.

J. S. S. INGLIS

Local Anaesthesia for Veterinary Surgeons (Translated Title). By I. I. MAGDA. 1960. pp. 276. Jena: Gustav Fischer. D.M. 33.60.

This translation of Magda's book from the original Russian into German brings it to the notice of a vastly increased reading circle. The original text has been altered in a few places and shortened somewhat, but the comprehensive nature of the book is unchanged.

The book is in two parts, the first of which begins with a section giving a short historical summary of the development of local anaesthesia in veterinary surgery. This is followed by sections on the different methods of local anaesthesia; the common local anaesthetic agents; preparation and potentiation of local anaesthetic solutions; syringes and needles; preparation of the patient; and contraindications and complications of local anaesthesia.

The second and greater part of the work is concerned with local anaesthesia for operations on the various parts of the body. This is covered in regions and successive chapters deal with the head, neck, chest, withers and abdominal wall. Anaesthetic techniques in different sections of each region, including general anatomy and nerve supplies, are dealt with in detail.

Separate chapters cover local anaesthesia of the genitourinary organs, the limbs and tail, and spinal anaesthesia. Anaesthesia for castration, ovariectomy and operations on the external genitalia is considered in detail. It is interesting to note that in the chapter on anaesthesia of the limbs of the various species, a separate section is devoted to nerve blocks about the limbs of the camel. Spinal anaesthesia is discussed in all species and the last chapter deals with anaesthesia of the nerves of the sympathetic system.

The book covers the subject of local anaesthesia in such a comprehensive manner that one is left wondering just how much of it is of practical use. Most veterinary surgeons in this country would no doubt prefer general anaesthesia to many of the techniques described, many of which are difficult to perform, and, to say the least, not without risk to the operator. Nevertheless, for those interested in anaesthesia this book fills a large gap and may well be used as a work of reference. The bibliography is extensive and the book is well illustrated by many half-tone and line drawings.

W. D. TAVERNOR

Bee-keeping in the Tropics. By F. G. Smith. London: Longman Green & Co. Price 45s.

Far from being just another "bee-book" this work by Dr. Smith is a thorough and far-reaching survey of bee-keeping and will certainly become a standard reference work in its field. The entire subject of bee-keeping is covered and with the large number of illustrations it will prove an invaluable text book to those living in the tropics or sub-tropics; those living in temperate climates will find that it throws light on a most interesting aspect of the subject of apiculture.

Dr. Smith is the Chief of the Bee-keeping Division, Forest Department, Tanganyika, and he has had a great deal of experience on which to base his exposition. He deals with the most modern methods of commercial apiculture and recommends a variety of hive which he calls the African Dadant. The more primitive methods of bee-keeping are not, however, neglected and a chapter is devoted to cylindrical hives and skeps. Great stress is laid on the necessity for the bee-keeper to realize that first-class equipment is no substitute for time and effort spent on the hives.

Early in the book the diseases and enemies of bees are thoroughly dealt with. The tropical bee-keeper in the Americas is lucky because, unlike Africa, bees are not indigenous there. In Africa, the imported *Apis mellifera* is attacked with the same fervour as the local *Apis adonii*. Dr. Smith points out the advantages of a bee-house both as a means of overcoming these pests, and also because he has found the bees more easy to handle since the older and fiercer bees which rush out of the front of the hive once it is opened cannot reach the apiarist working within the house. It needs to be pointed out that the cost of such a bee-house would add considerably to capital outlay, and would probably only be justified where the pests are plentiful and the bees of a particularly vicious nature.

A valuable feature of the book is that the facts and figures of the finances of bee-keeping are clearly set out. This is most useful to anyone proposing to start as a bee-keeper and infinitely more valuable than any number of vague generalizations about the great potential profits in honey. To the people of Tanganyika and neighbouring countries who have both an interest and perhaps capital in bees this book will bring renewed encouragement.

D. Gemmill

A Bibliography of Farm Buildings Research, 1945–1958. *Part IV: Buildings for Cattle.* Agricultural Research Council. London and Silsoe. Price 4s. 6d.

This bibliography contains nearly 400 references to experiments and observations connected with dairy cattle environments and published since 1945. The literature review consists mainly of the environmental needs of adult dairy cattle, housing the dairy herd, the design of equipment and buildings for both beef and dairy cattle, and methods of feeding housed cattle. Each of the references listed is abstracted and this ensures that the bibliography is especially useful to research workers concerned with the physiology and

environmental requirements of cattle. The Agricultural Research Council intends to keep the bibliography up to date by publishing supplements.

C. G. PAYNE

Sheep Management and Diseases. H. G. BELSCHNER. 6th edition, 814 pp. London: Angus & Robertson. Price 90s.

Dr. Belschner, who was chief of the Division of Animal Industry of New South Wales Department of Agriculture and is now a university lecturer in sheep husbandry and diseases, is regarded as one of Australia's leading authorities on sheep. It is not surprising, therefore, that he has been able to produce a very valuable book dealing with all aspects, and the fact that it has reached the sixth edition within ten years of its first publication is ample evidence of its worth.

The author says the book is intended as a text-book for students at agricultural and technical colleges, for university students studying veterinary science and agriculture, and for prospective sheep farmers and beginners. Whilst agreeing with this, the writer is of the opinion that experienced sheep farmers and veterinary surgeons will also find much of interest and value.

A very important feature of the book is that it deals equally well with both sheep husbandry and diseases, and throughout the importance of good husbandry in relationship to disease prevention is rightly stressed. For this edition the text has been revised throughout in the light of recent advances and many additions and amendments have been included.

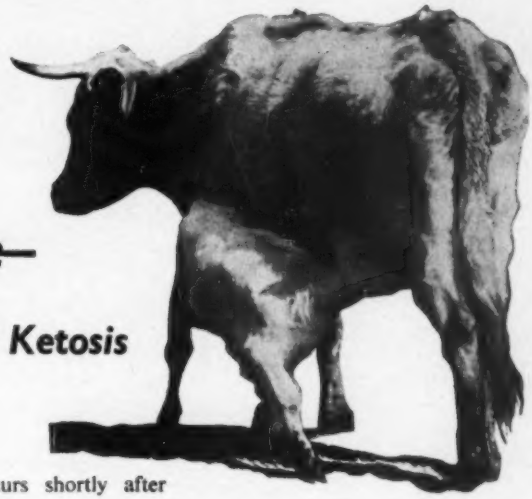
It must be emphasized that this book is based entirely on Australian conditions, so that the Merino and wool production play a leading role, and conditions, foods and problems peculiar to Australia are of course described. The British reader will, therefore, find some parts of the book only of general interest, and will miss points associated with his own sheep husbandry and diseases, but nevertheless, with regard to routine aspects of management and diseases common to both countries, he will find much of great value.

For those readers unfamiliar with this book, Part I (380 pp.) deals with "Sheep Management", Part II (379 pp.) with "Diseases of Sheep", and then there is an Appendix with sections on "Drugs and Dosages", "Disinfection", miscellaneous information, and a glossary of sheep and wool terms. Finally, an index completes the book. Each chapter is well presented, very readable, well illustrated and followed by a list of references.

Part I commences with the important role of sheep in the Australian economy. The Merino breed is dealt with in detail, but there is also a good deal of information about most of the British breeds. Then follows a very complete description of all aspects of sheep management. The principles of sheep breeding are described with particular reference to the improvement of wool; the principles of feeding are outlined too, again with the emphasis on grasses and vegetation peculiar to Australia, and drought feeding and provision of water call for very special comment. Buildings and sheep-handling equipment are also described. There is a very exhaustive chapter on the control of blow-fly strike with excellent descriptions and photographs of the various Mules operations.

Simple–
Rapid–
Effective–

control of Bovine Ketosis



Post-partum ketosis which occurs shortly after parturition and the serious losses due to this condition can now be minimized and controlled by

DI-ADRESON-F* (VETERINARY)

Most cases respond fully to a single intramuscular injection (100 mg.) without additional treatment, even in animals which have previously failed to respond to other forms of treatment.

Di-Adreson-F* (Veterinary), in 10 ml. vials each containing 10 mg. per ml. Prednisolone in aqueous suspension is approximately 5 times as active as cortisone or hydrocortisone and provides rapid physiological effect with ease of administration.

Reference : Shaw, J.C. (1955) Advances in Vet. Sci. *ii*, 262-360.
Huber, W.G. (1958) Vet. Med., *53*, 55.
Link, R.P. et al (1957) J. Amer. vet. med. Ass., *130*, 137.

**Registered Trade Mark*

ORGANON

Sole Veterinary Distributors in the United Kingdom and Republic of Ireland :
C. J. Hewlett & Son Ltd., King George's Avenue, Watford
Telephone: Watford 34401 (4 lines) Telegrams: Pepsine, Watford

Hedisan

AN EFFECTIVE ANTISERUM FOR PROPHYLAXIS AND TREATMENT OF CANINE

DISTEMPER
HARD PAD
HEPATITIS

Only Hedisan combines antibodies specific against distemper, hard pad, hepatitis and leptospirosis.

Hedisan is for immediate administration to unprotected dogs when they have been exposed to any or all of these conditions. It is also of value in the treatment of the early stages of these diseases. The antileptospiral component is, however, variable and only 50% success is possible in the presence of clinical disease, though there is sufficient concentration to deal with latent infection. For the treatment of active leptospirosis, Leptospira Antiserum is recommended.

Hedisan may be administered simultaneously with Hedivac, the related Combined Distemper/Hard Pad and Hepatitis Vaccine. Hedisan is available in 50 ml. rubber-capped bottles. The dose is 1 ml/lb body weight for prophylaxis, 2 ml/lb body weight for treatment.

Hedisan is manufactured by Behringwerke AG., whose experience in the production of vaccines and antisera for both human and animal use dates from Emil von Behring's discovery of the diphtheria antitoxin in 1892—nearly 70 years.

Hedisan

COMBINED CANINE DISTEMPER HARD PAD AND HEPATITIS ANTISERUM

PADISAN, a potent distemper/hard pad antiserum, is also available for use when protection against distemper/hard pad only is desired.

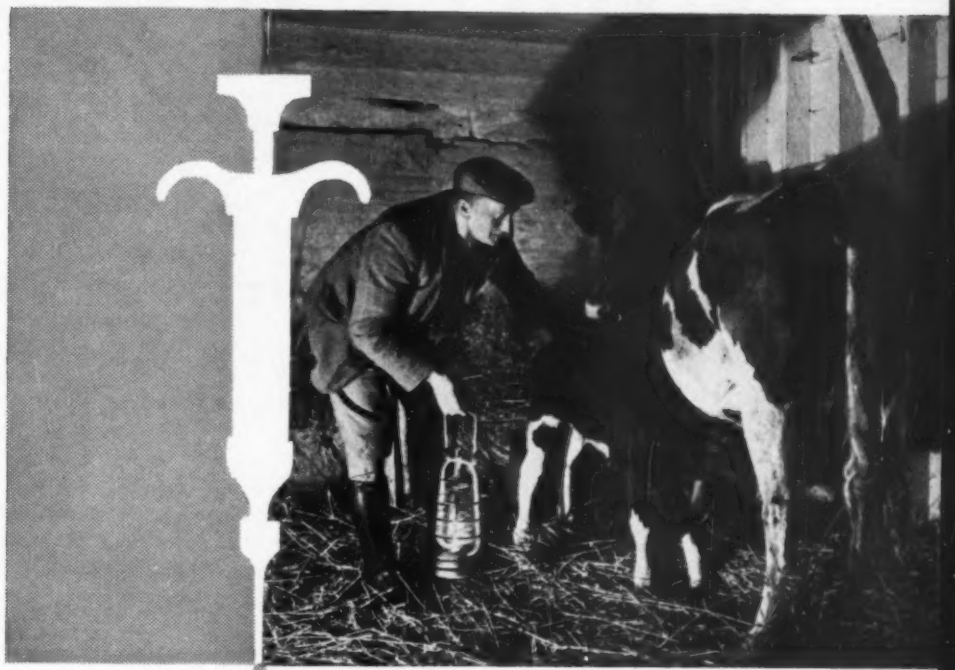
HOECHST

For further information, please write to
HOECHST PHARMACEUTICALS LIMITED, VETERINARY DIVISION, SLOUGH
Sole distributors in the United Kingdom: Horlicks Limited, Slough, Bucks
Telephone: SLOUGH 22322 (6 lines). Telegrams: HORLICK, SLOUGH

... by fertility out of

Dinovex

TRADE MARK



In the treatment of functional sterility Dinovex Oestrogenic Solution provides:

- **Oestrogen during oestrus**
- **Direct stimulation of the maturing follicle to ovulate**
- **More rapid absorption and elimination**
- **Reduced risk of cysts and of prolonged luteinization**
- **Low cost treatment**

In cartons of six 5 c.c. vials each containing 1 mg. Dienoestrol per c.c. of solution for subcutaneous injection

LITERATURE ON REQUEST

Ortho Pharmaceutical Limited
Veterinary Division
Saunderton · Buckinghamshire

LAMB DYSENTERY
PULPY KIDNEY

Concentrated Lamb Dysentery Antiserum

Lamb Dysentery & Pulpy Kidney Antiserum

Pulpy Kidney Antiserum

Lamb Dysentery Vaccine.
(formolised whole culture)

Improved Lamb Dysentery Vaccine.

Pulpy Kidney Vaccine.
(formolised whole culture)

Improved Pulpy Kidney Vaccine.
(alum precipitated)

Stockists for all products of the Behringwerke A.G. and Farbwerke Hoechst A.G.

INTERNATIONAL SERUM CO. LTD. The Paddocks, Frith Lane, Mill Hill, N.W.7.

Telegrams: Interserum, Norphone, London. *Telephone: FINchley 5554*

AEROSOL 356

for the treatment of ringworm and other mycotic infections. AEROSOL 356 contains dichlorophen and an antiseptic agent.

ODOUR SUPPRESSANT AEROSOL

will mask the characteristic odour of bitches "in season," and prevent the undesirable attentions of male dogs. ODOUR SUPPRESSANT AEROSOL is also a pleasant and effective air freshener, and may be used in kennels and surgeries.

Both products available in cartons of 6 or 12 units.

Prices and literature on request

SOMERSET PHARMACEUTICALS LTD.

WELLINGTON. SOMERSET

Telephone: Wellington, Somerset 2244

These are of great interest but unnecessary under British conditions. Finally, shearing and the handling of wool receive great attention, but meat production is mentioned briefly.

Part II begins with some elementary anatomy and physiology for the benefit of non-veterinary readers. Chapter 16 deals with the investigation of disease, and again shows the difference in Australian conditions where distance from veterinary services frequently compels the sheep farmer to do more for himself. Instruction is given in post-mortem technique, collection of material for laboratory examination, and the administration of medicines.

The rest of this part deals with diseases under the headings—Infectious diseases, Non-infectious diseases, Parasitic diseases due to internal parasites, Parasitic diseases due to external parasites, Wool and skin diseases, Poisons, and finally Wounds and Fractures. Here, the reader will find up-to-date information on the many diseases found also in Britain. A few minor criticisms may be mentioned. Hypocalcaemia and hypomagnesaemia do not appear to be distinguished. In the chapter on dystocia, no mention is made of "ring-worm", nor is there any reference to Caesarean section, which is common practice in Britain. Presumably it is not suited to conditions in Australia. Prolapse of the vagina is described, but no mention is made of recent developments in treatment.

Dr. Belschner is to be congratulated on producing a very useful book, which will be most helpful to all interested in sheep.

P. S. BRIDGE

Malaysian Parasites, XXXV–XLIX. Edited by W. W. MACDONALD. Studies from the Institute for Medical Research, Federation of Malaya, No. 29, 1960.

This volume, Study No. 29 from the Institute for Medical Research at Kuala Lumpur, contains 15 papers embodying the separate or conjoint work of 13 authors. Trombiculid mites, as in the two previous volumes on Malaysian Parasites (Studies No. 26 and No. 28) still command some space. Six papers are on this group; these include descriptions of new genera and species, of hitherto undescribed stages, and an account of trombiculids from the eyes of mammals.

Authors include authorities such as Audy, Nadchatram, Traub and Domrow. Mites of other kinds—from mongoose and porcupine—are the subject of two other papers. Here again new genera and species are described by Domrow & Baker, and by Keegan and colleagues. C. B. Philip contributes two papers on the horseflies of the Far East. One gives descriptions and other taxonomic detail, together with line drawings. It includes numerous new species. The second paper is a review of all available records of tabanids from Malaya, Borneo and Thailand with extensive keys for identification down to species. The seven genera in the region provide 153 species and sub-species, of which only four are common.

Two further papers deal with mosquitoes. One, by W. W. Macdonald, is on the systematics and ecology of *Armigeres* and the other, by Macdonald & R. Traub, considers the ecology of forest mosquitoes of Selangor. This gives a good deal of condensed information for some of the 163 species concerned;

further work has to be done on the material collected and this may mean 25–30 new species will be identified and defined from the region. One paper, by Schacher and Chee-Hock, deals with nematode parasites of Malayan house rats of the genus *Rattus;* twelve species of helminth are reported upon and one (*Rictularia tani*) redescribed, with illustrations.

Ticks are the subject of two papers. The first is on breeding methods, especially as used for *Ixodes granulatus* of forest rodents and *Amblyomma geoemydae* from tortoise. The life cycle for the former requires 174–272 days, and for the latter 185–271 days. The second paper on this group is a detailed report of tick infestations from 17,683 animals (reptiles, birds, mammals) collected by the Institute from 1952–59. Two viruses were isolated in the course of these studies—one (TP21) from *Ixodes granulatus* and one (TP19) from *Amblyomma cordiferum.* The former is of the tick-encephalitis/louping-ill group; the latter awaits further examination.

D. S. BERTRAM

Veterinary Medicine. D. C. BLOOD & J. A. HENDERSON. 1,024 pp. London: Baillière, Tindall & Cox Limited. Price 84s.

In reviewing a book one looks for mistakes and refers to them to indicate that one has read the book. This is such a good book that the few omissions or mistakes do not detract from its value.

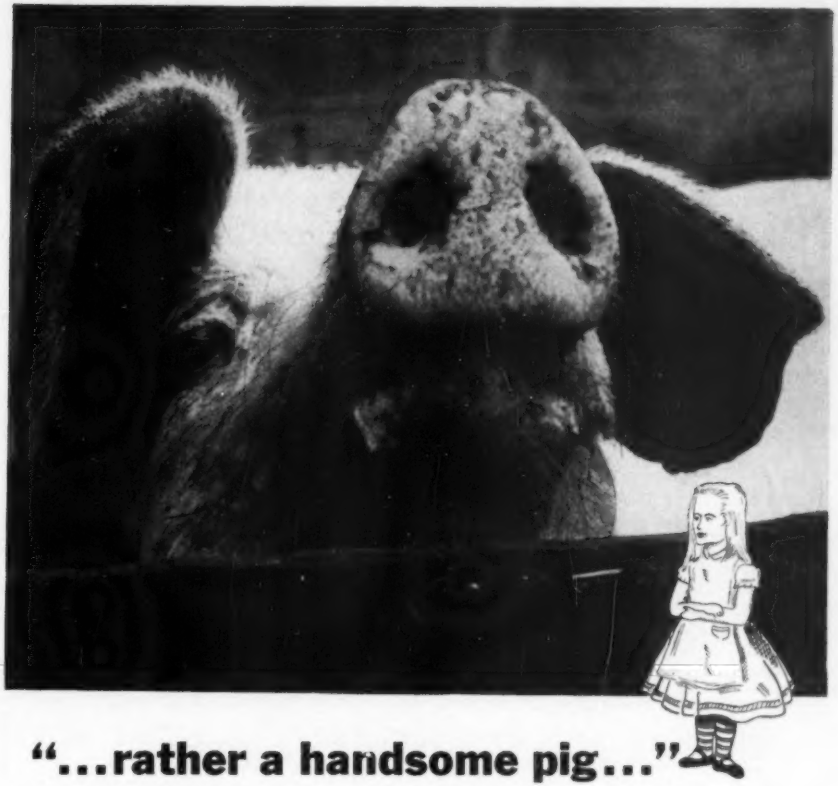
This is "a new major text-book written primarily for the veterinary student but which will also be of value to practising veterinary surgeons". The book undoubtedly lives up to these claims. It is one of the best text-books on veterinary medicine that I have seen and should be in the possession of every student and indeed every practitioner.

The book does not deal with the small animal side of veterinary medicine or with poultry. Obviously parasitology must be a separate subject from veterinary medicine in the curriculum of the Ontario Veterinary College as hoose or husk is not dealt with. It is true that parasitic lung worms are mentioned in the aetiology of pneumonia and also later on in reference to the aetiology of fog fever. It is difficult to understand why such an important subject has been omitted.

The book is surprisingly up to date, but one had hoped to see some reference to the spread of brucellosis via the milking process. Shanks was the first worker to discribe bowel oedema and Lamont gave the first description of a virus pneumonia in pigs in the United Kingdom in 1938. Nevertheless, the book has many references to work outside North America and the authors undoubtedly have cast their net widely.

The layout of the book is good; the whole subject of veterinary medicine is dealt with in a logical manner. General medicine is followed by special medicine, and the authors are to be congratulated on the amount of material they have included under special medicine. One thought of various rare diseases and then looked at the index, found them, and then looked them up to find an adequate description. Altogether there are over 1,000 pages, but it is a well written, concise work and can be highly recommended.

H. G. LAMONT



"...rather a handsome pig..."

". . . so she set the little creature down and felt relieved to see it trot away quietly into the wood." "If it had grown up," she said to herself, "it would have made a dreadfully ugly child; but it makes rather a handsome pig, I think." And she began thinking over other children she knew, who might do well as pigs, and was just saying to herself, "If one only knew the right way to change them—"

ALICE IN WONDERLAND—LEWIS CARROLL.

The changing of children to pigs doesn't concern us but we *are* interested in the "handsome pig." The secret of changing anaemic pigs into healthy, blooming, thriving pigs is . . . Imposil.

Imposil contains 150 mg. of iron in every 2 c.c. injection. One injection, given to the piglet on the third day of life, ensures that a piglet is fully protected from iron deficiency for the vital first four weeks of life.

Imposil is available from Veterinary wholesalers in 20 c.c. vials (10 doses) at 16/8d. and 50 c.c. vials (25 doses) at 40/-.

Imposil

TRADE MARK BRAND OF FERRIMICRODEX

BENGER BENGER LABORATORIES LIMITED · HOLMES CHAPEL · CHESHIRE

544

Prescription Diets

The following diets have been formulated for use in small animal practice. They are issued only to Veterinary Practitioners and to Scientific Institutions.

DIET NO. 1 : High Protein Diet
DIET NO. 2 : Carotene Milk Fat Diet
DIET NO. 3 : Slimming Diet

Details and information relating to clinical and other applications will gladly be forwarded

THE VETERINARY DIVISION OF BOB MARTIN LTD
SOUTHPORT LANCS

ANIMAL PRODUCTION

JOURNAL OF THE BRITISH SOCIETY OF ANIMAL PRODUCTION

Contents of Volume 3, Part 1, February 1961

MAHADEVAN, P., and MARPLES, H. J. S. An analysis of the Entebbe herd of Nganda cattle in Uganda.
FRASER, J. D. A comparison of whole milk with buttermilk in the rearing of calves for veal. 1. Rearing and growth.
BARTON, R. A., and KIRTON, A. H. A comparison of whole milk with buttermilk in the rearing of calves for veal. 2. Slaughter and carcass composition data.
SHORTHOSE, W. R., and LAMMING, G. E. The effect of testosterone and oestradiol on growth rate and carcass quality of fattening hoggets.
PRESTON, T. R., CHARLESON, E. B., MACLEOD, N. A., ROSEN, G. D., and VERNON, J. The effect of Hydroxyzine of growth, endocrine, and carcass characteristics of lambs.
BLAXTER, K. L., WAINMAN, F. W., and WILSON, R. S. The regulation of food intake by sheep.
OWEN, J. B., and INGLETON, J. W. A method of collecting faeces from ewes.
HALE, R. W. Heritabilities and genetic correlations of egg production and other characters in a White Wyandotte flock.
WATSON, J. H. The influence of contemporaneity, genetic variation and herd differences on milk yield and fat percentage.
LODGE, G. A., and McPHERSON, R. M. Level of feeding during early life and the subsequent reproductive performance of sows.
BELLIS, D. B. Supplementation of bacon pig rations by aureomycin and copper sulphate.

This journal is a continuation and expansion of THE PROCEEDINGS OF THE BRITISH SOCIETY OF ANIMAL PRODUCTION (1944-58) and appears three times per year in February, June and October. The annual subscription is 45s. ($7.50 in U.S.A. and CANADA), single parts 17s. 6d. ($2.75 in U.S.A. and CANADA) net. Orders and subscriptions should be sent to:

OLIVER AND BOYD LTD.
Tweeddale Court, 14 High Street, Edinburgh, 1

VETERINARY INSURANCE SERVICES LIMITED

Directors:
M. D. BERWYN-JONES, M.R.C.V.S.
A. C. S. EAGLES
R. J. HURST, F.C.I.B.

TAX FREE PENSION PROVISION

The Society's unique Veterinary Surgeon's Pension provides a tax-free income from age 65 or date of death, whichever is earlier until the 85th birthday. Thereafter, an annuity is payable so long as either the Veterinary Surgeon or his wife shall survive.

As in all V.I.S. contracts, waiver of premium benefit is available. This allows for the cessation of premiums in the event of disablement by sickness or accident for a period in excess of six months.

If you would like particulars, please complete and post the enquiry slip below.

To: THE VETERINARY INSURANCE SERVICES LTD.
131-133, New London Road, Chelmsford, Essex.

Please let me have the details of :
THE VETERINARY SURGEON'S PENSION POLICY

Name .....

Address .....

.....

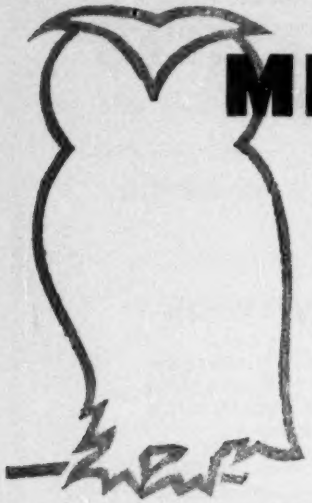
..... Tel. No. .....

Date of birth ..... Wife's date of birth .....

The V.I.S. transacts all classes of insurances including
VETERINARY SURGEON'S PERSONAL AND FAMILY POLICIES, THE SCHOLASTIC PLAN AND THE SURGERY COMPREHENSIVE POLICY

If you wish information regarding these or any other types of insurance please indicate here.....

THE HOUSE OF HEWLETT · ESTABLISHED 1832



MILK FEVER

CALCIUM BORO-GLUCONATE P
combines calcium and phosphorus in the 2:1 ratio of normal blood. Indicated where the fall in blood levels is proportional.
Bottles of 400cc with yellow caps.

CALCIUM BORO-GLUCONATE P.M.
contains magnesium in addition. Indicated when hypocalcaemia and hypophosphataemia are further complicated by hypomagnesaemia.
Bottles of 400cc with red caps.

CALCIUM BORO-GLUCONATE P.M.D.
conforms to the previous two but contains 20% dextrose for milk fever complicated by acetonaemia.
Bottles of 400cc with blue caps.

Plain CALCIUM BORO-GLUCONATE *is available in strengths of 20% and 40% in 400cc bottles with green caps.*

To the Veterinary Profession Only.

C. J. Hewlett & Son
Division of Astra-Hewlett Ltd.
King George's Avenue, Watford, Herts.

Telephone: Watford 34401
Telegrams and Cables: Pepsine Watford

"ESSDIM 333"
Injection of Sulphadimidine Solution 33·1/3%.
The injection of choice. Covers a wide range of bacterial infections in all stocks.
Bottles of 100 c.c., 500 c.c., 2000 c.c.

"ESSDIM" 5 GRAMME SULPHADIMIDINE TABLETS
Rapidly absorbed; produce high and prolonged blood levels; well tolerated.
Cartons of 50.

"TRIP-O-TABS"
Useful 5 Gramme Tablet of Sulphadiazone B.P. 1·85 gm. Sulphathiazole B.P. 1·85 gm. Sulphadimidine B.P. 1·30 gm.
Cartons of 30 and 60.

LEONARD SMITH & COMPANY
(Dept. B.V.J.)
(Branch of A. S. Price & Co. Ltd.)
BLACKHEATH · BIRMINGHAM

TENNANTS VETERINARY MAGNESIA

CALCINED MAGNESITE

87% MgO MINIMUM

TENNANTS (LANCASHIRE) LTD

Hazelbottom Road,
Cheetham, Manchester, 8

Telephone:
Collyhurst 4454 (4 lines)

NOTICE TO CONTRIBUTORS

1. *The British Veterinary Journal* publishes original papers and reviews on all aspects of veterinary science and kindred subjects. Accounts of clinical observations are published and, in the form of letters to the editor, preliminary reports of scientific studies. Reviews should, in general, be written in support of original investigations.

2. *Manuscripts*, written in the English language, should be sent to the Editor, *The British Veterinary Journal*, 7 and 8 Henrietta Street, London, W.C.2. Papers are accepted for publication on the understanding that they have not been published and are not being considered for publication elsewhere, and that they may not be re-published without sanction from the publishers.

3. Contributions, which may be subject to editorial revision, should be condensed as far as possible and should be submitted as a top typewritten copy on one side of the paper only, with double spacing and ample margins. The spelling should be that of the Oxford English Dictionary.

4. Manuscripts should be headed with the title of the paper, the name and postal address of the author or authors, or, where applicable, the address of the institution where the work was done. They should conclude with a factual summary equal to about 3 per cent. of the length of the paper. References to previous work should be cited in the text with the author's name and the year of publication in parentheses, e.g., "Brown (1957) showed that . . ." Where there are more than two authors the names of all should be cited on the first occasion in the text and thereafter only the first followed by *et al.*, e.g., "Brown *et al.* (1957) . . ." In the list of references at the end of the paper all the authors' names and initials should be included. The references should be listed in alphabetical order of the surnames of the authors, and the titles of the journals should be abbreviated in accordance with the *World List of Scientific Periodicals*, e.g., Brown, A. B. (1957) *Brit. vet. J.*, **113**, 217.

5. *Illustrations* should be numbered in arabic numerals in the order in which they appear in the text and all referred to as "figures," and should be somewhat larger than the size desired for reproduction. Drawings, diagrams and graphs should be in black ink on Bristol board or stout, smooth white paper. Letters and numbers should be indicated on them lightly in pencil. Photographs and photomicrographs should be printed on glossy paper. X-ray films should not be submitted, but prints of them, preferably negative prints. The areas to be reproduced of the photographic illustrations, if less than the whole, should be outlined *lightly* in pencil on the back of each. All illustrations, diagrams, etc., should bear on the reverse side the author's name, a short title of the paper and a figure number. Legends should be typed on a separate sheet of paper and should not be attached to the illustration. A statement of the magnification of illustrations should be given where it is applicable.

6. Illustrations in colour can be accepted provided that the author is willing to bear the cost of their reproduction. Authors may also be required to contribute to the costs of reproducing black and white illustrations in cases when the costs are particularly heavy.

7. *Tables* should be typed on separate sheets and numbered in roman numerals in the order in which they are referred to in the text and their size and number should be limited to the minimum necessary for clarity.

8. *A proof* of each article is sent in duplicate to the author. Minor corrections to the proof are permitted, but major alterations will be carried out only at the author's expense.

9. *Reprints* of articles and extra copies of the journal can be supplied if they are ordered when the galley proofs are returned to the publishers. An order form is sent out to authors with the proofs. A copy of the journal and twenty off-prints of each article are supplied free and will be sent to the author, or to the senior author if there is more than one, as soon as the article has been published.

Annual subscription, 50s. post free (U.S.A. and Canada, $8.50) payable in advance. Single copies, 5s. each. Special students' subscription rate, 30s. post free in the U.K. only.

LONDON: PRINTED FOR BAILLIERE, TINDALL AND COX LTD., 7–8 HENRIETTA STREET, COVENT GARDEN, W.C.2
BOURNEHALL PRESS LTD., BUSHEY, WATFORD, HERTS.

THE BRITISH VETERINARY JOURNAL

MARCH 1961

LIST OF CONTENTS

A Fatal Ulcerative Mucosal Condition of Sheep associated with the Virus of Contagious Pustular Dermatitis 97
J. H. Darbyshire

Studies on the Climate of Broiler Houses—
II. Comparison of Ventilation Systems 106
C. G. Payne

Plasma and Blood Volumes in Ayrshire Cattle 115
R. G. Dalton and E. W. Fisher

The Pubertal Change in the Growth Curve for Mice and the corresponding Rates of Loss of Heat 120
A. E. Hawkins

The Duties of a Veterinary Surgeon at a Race Meeting 128
Horace Bell

Book Reviews 131